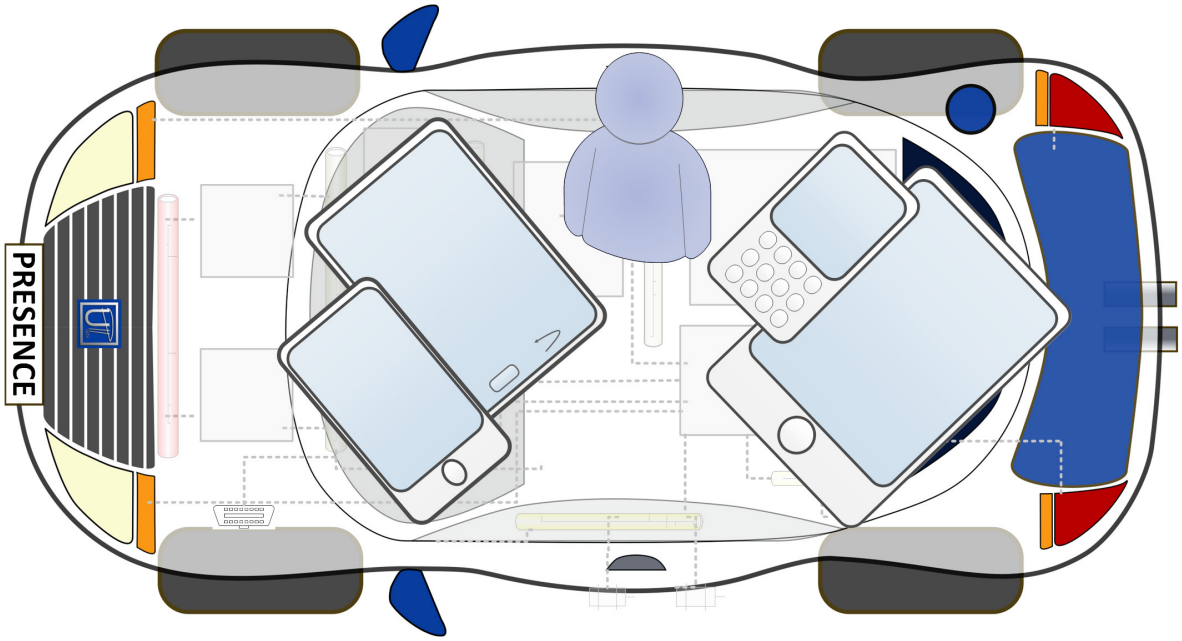
PRESENCE - PRIVACY-ENABLED, SECURED INTERACTIONS BETWEEN VEHICLES AND SMART ELECTRONIC DEVICES

Goal of the project:

The main target of the project is the design, analysis and implementation of security and privacy mechanisms for mediating access to in-vehicle functionalities by using intelligent mobile devices instead of classical RF and/or mechanical vehicle keys that are rigid and are lacking in terms of configurability and functionalities. The design of such security solutions is challenged by limitations on computational capabilities of existing components, e.g., in-vehicle controllers, as well as by the potential insecurity of smartphones.



Short description of the project:

PRESENCE addresses the security of the newly emerged ecosystem of modern vehicles that interact with intelligent mobile devices, e.g., smart-phones.

Project implemented by

Politehnica University Timișoara

Implementation period:

2018-2020

Main activities:

Our project calls for the use of security enforcing technologies (e.g., NFC security cards) and modern device pairing techniques by harvesting environmental data (e.g., accelerometer data) to provide a secure and usable solution. Privacy enhancing technologies also need to be put in place in order to protect the users in front of corrupted cloud owners. As deployment platform we target Android, the mobile OS with the largest installed base. We also test the computational feasibility of the proposed solutions on a commonly employed controller for car BCMs. Main project objectives:

1. Design, analysis and implementation of security protocols.
2. Security enforcing technologies (e.g., NFC cards).
3. Ecosystem-based device association (e.g., accelerometer data).
4. Cloud-based access control.
5. Connectivity to in-vehicle control units.

Results:

We expect 5-10 research papers in relevant workshops and journals in the field addressing new concepts in vehicle access control supported by practical deployments on real-world components. PRESENCE is still in its first year of run, the publication list will be updated on the project website.

[1] Tudor Andreica, Bogdan Groza, Stefan Murvay, Applications of Pairing-Based Cryptography on Automotive-Grade Microcontrollers, 1st International Workshop on Safety, securiTy, and pRivacy In automotiVe systEms (STRIVE 2018, SAFECOMP 2018 Workshops), Vasteras, Sweeden.

[2] Camil Jichici, Bogdan Groza, Stefan Murvay, Examining the Use of Neural Networks for Intrusion Detection in Controller Area Networks, 11th International Conference on Innovative Security Solutions for Information Technology and Communications, SecITC 2018, Bucharest, Romania, 2018

Applicability and transferability of the results:

Replacing traditional keys with smartphones appears like a natural step for achieving increased usability and an improved user experience. Industry application of the designed protocols and implemented functionalities for car access control by modern smartphones is immediate.

Financed through/by

CNCS-UEFISCDI PN-III-P1-1.1-TE-2016-1317, 2018-2020

Research Centre

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SECURITY ENHANCEMENTS AND VULNERABILITY ASSESSMENT FOR INDUSTRY-STANDARD NETWORKS (SEVEN)

Goal of the project

Since most attacks on industry-standard networks rely on vulnerabilities the SEVEN project aims to assess vulnerabilities in protocols not yet analyzed. For adding security to industrial networks we propose mechanisms to assure basic security objectives (e.g. authenticity, confidentiality or key management). The project will also investigate and design intrusion detection systems. Finally, we also consider a performance impact evaluation of the introduction of the designed security solutions.

Short description of the project

Vulnerability evaluation and development of protection mechanisms for in industry-standard networks.

Project implemented by

Pal-Ștefan MURVAY (Project leader)
Bogdan GROZA (Mentor)

Implementation period

02/05/2018-30/04/2020

Main activities

The project is structured around three main activities.

The first main activity focuses on vulnerability assessment of industry-standard communication protocols. Our goal is to identify industry-standard communication-protocols that were not analyzed from a security perspective and identify potential vulnerabilities.

Our first approach for enhancing the security of industry-standard communication protocols is the development of mechanisms for assuring basic security objectives such as: authenticity, confidentiality or key management.

A second approach focuses on designing intrusion detection mechanisms for the early identification of attack attempts.

Finally, we intend to provide an evaluation of the performance impact of the proposed mechanisms.

Results

The results obtained in the first phase of the SEVEN project have been published as part of two conference papers. Both focus on the first main project activity, i.e., vulnerability assessment of industry-standard communication protocols.

Our first result covers the identification of vulnerabilities in the FlexRay communication protocol. We identified a set of denial of service attacks that can affect the entire communication or just targeted frames. We also found that FlexRay frames sent in the dynamic segment can be falsified.

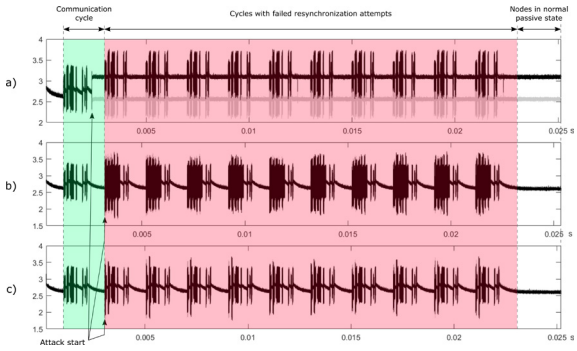

Figure 1. Three variants of the DoS attack for the entire communication.

A second line of research focused on the DeviceNet protocol. We found that DeviceNet is vulnerable to a set of denial of service attacks that can prevent a node from achieving communication on the network while not affecting the communication between other nodes.

Applicability and transferability of the results

Our results add to the already known vulnerabilities of communication protocols used in industrial applications.

Without proper mitigation mechanisms these attacks can be used by malicious parties to disrupt communication of safety critical systems in an automotive environment (in the case of FlexRay) or in an industrial control system (in the case of DeviceNet).

Knowledge of the vulnerabilities is an important building block of designing proper security mechanisms for these communication protocols.

Financed through/by

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P1-1.1-PD-2016-1198, within PNCDI III

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NONLINEAR OBSERVERS-BASED CONTROL STRUCTURES APPLIED TO MECHATRONICS SYSTEMS

Goal of the project

The main objective of this project is to develop the necessary tools, modern control solutions and theoretical framework for later multi-purpose applications related to mechatronics systems.
The following objectives are defined:
01. Analysis, design and implementation of modern control solutions.
02. The validation of the proposed modeling and control approaches using simulations and experiments.
03. The dissemination of results.
04. Solving the project management issues.

Short description of the project

It is focused on the analysis, synthesis, modeling and development of modern control solutions.

Project implemented by

The construction of nonlinear observers still provides an open research field, efforts being made to broaden and adapt the proposed techniques in order to widen the classes of nonlinear systems to which they may apply.

Implementation period

10/10/2018 - 09/10/2020

Main activities

The main activities are as follows:
1. The elaboration of the synthesis on the operation and modelling of the proposed approaches.
2. The development and verification through simulation and experiments of the proposed control solutions for several classes of processes including those in mechatronics applications and laboratory control systems.
3. The development of Matlab / Simulink programs to test the proposed nonlinear observers.
4. The elaboration of comparative analyses to prove the validity of the approaches.

The potential impact to the scientific field may be significant because through new concepts and employed approaches, a new way for the use of highly advanced control designs in mechatronics applications is open.

Results

The targeted deliverables of this project are: 1 journal paper (e.g. IEEE Transactions on Industrial Informatics, IEE Transactions on Control Systems Technology, IET Control Theory & Applications, International Journal of General Systems, International Journal of Computers, Communications & Control, Acta Polytechnica Hungarica) and 3 conference papers published in the volumes of visible international conferences.
It is possible that more publications in this area of research will follow after the project has ended but it is very risky, due to the fact that the whole cycle of research - validation - writing manuscript - submission -revisions - acceptance lasts for at least 2 years for high quality publications.

Applicability and transferability of the results

The potential impact of the project in the scientific, social, economic or cultural environment is straightforward since the investigated topics can lead to automated tools for controller design and tuning. Although there is a wide range of possibilities for creating new themes for state-of-the-art research, noteworthy is also the impact in the socio-economic environment with directly applicative directions. In the project all mechatronics applications are focused on those applicable cost-effective training systems in the fields of robotics, automation and process control.

Financed through/by

The state budget / UEFISCDI

Research Centre

Politehnica University Timişoara (UPT)
Department of Automation and Applied Informatics

Research team

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Prof. Radu-Emil PRECUP, PhD

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INTERNET OF THINGS MEETS COMPLEX NETWORKS FOR EARLY PREDICTION AND MANAGEMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Goal of the project

To address the problem of COPD (Chronic Obstructive Pulmonary Disease) management in a big population of individuals, using a personalized medicine approach that relies on big data gathering and modeling, according to the complex network paradigm. Our scope is to demonstrate a solution that consists of a mobile and cloud computing integrated system for COPD early detection, monitoring, and management.

Short description of the project

COPD is defined as the irreversible clinical condition which reduces pulmonary capacity; if diagnosed in an early phase, its evolution can be controlled. Unfortunately, the early detection of COPD is a difficult task. Capitalizing on recent research results which indicate the Internet of Things solutions as useful in monitoring and managing respiratory disorders, we propose a prototype system for early detection and evolution prediction of COPD. As such, we build a sensor network that gathers multiple physiological signals, and a mobile application that extracts the multi-fractal spectra as signal signatures. Then, the mobile system integrates the physiologic signatures with individual clinical data. On the server side, we collect the integrated data from a population of individuals, to build a complex network model of patients. To this end, we employ modularity clustering and network layout tools to build prediction models for both early detection and evolution prediction of COPD. The prediction model is instantiated as a smartphone application and tested to assess its predictive capacity.

Project implemented by

The research group lead by Mihai Udrescu and affiliated to Advanced Computing Systems and Architectures Lab, Politehnica University Timișoara, and the Pulmonology Research Group from "Victor Babeș" University of Medicine and Pharmacy lead by Ștefan Mihăicuță.

Implementation period

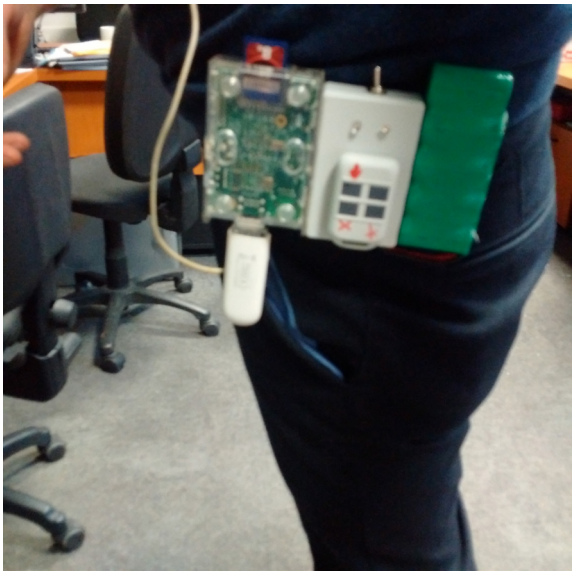
3.01.2017 – 30.06.2018

Main activities

Designing and implementing the mobile software that records anthropometric and clinical data, building a prototype sensor network for collecting physiological signals, implementing the software for multifractal analysis of gathered physiological signals, finding correlations between parameters and data using a complex network model, implementing a software COPD-stage predictor based on the physiological signals.

Results

1. Methodology for processing medical data based on complex network analysis, which allows for identification of clinically-relevant patient phenotypes. The proposed methodology is published in: Mihaicuta, S., Udrescu, M., Topirceanu, A., & Udrescu, L. (2017). Network science meets respiratory medicine for OSAS phenotyping and severity prediction. PeerJ, 5, e3289.
2. Experimental hardware/software platform for gathering and integrating anthropometric, clinical data with physiological signals from COPD patients.



Research centre

Research Center in Computing and Information Technology (CCCTI)

Research team

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Alexandru IOVANOVICI,
Constantina-Elena GAVRILIU,
Stefan MIHAICUTA,
Daniela REISZ,
Rodica DAN,
Carmen ARDELEAN.

Applicability and transferability of the results

Active diagnosis and monitoring systems using a wearable sensor network with application in monitoring respiratory disorders.

Financed through/by

CNCS/CCCDI-UEFISCDI, project number PN-III-P2-2.1-PED-2016-1145, within PNCDI III, contract no. 31PED/2017

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AUTOMATED RECOVERY OF ARCHITECTURAL INFORMATION FROM SOURCE CODE (AREAS)

Goal of the project:

The goal of the project is to develop and validate automatic recovery methods of the architectural information from the code, which is an important activity for program comprehension. Program comprehension, an essential prerequisite for any maintenance activities, consumes a significant part of software budgets. Supporting the program comprehension activity by intelligent tools is an important mechanism for cost reduction.

Short description of the project:

The project developed the AReAS technology, which comprises: establishing the primary artifacts that must be considered in the recovery process, the framework that captures which are the relevant relationships between them, and the algorithms that work best for abstracting or extracting architectural information.

Project implemented by

The project was implemented by a team from the Department of Computer and Information Technology,
Politehnica University Timișoara.

Implementation period:

August 2017-December 2018

Main activities:

Phase 1 activities:
A1.1. The development of initial methods for architectural information recovery from the source code
A1.2. The development of the experimental methodology and of the evaluation tools for the experimental results
A1.3. The design of the software tool prototype architecture
A1.4. The enhancement and extension of the architectural information extraction methods from the source code

Phase 2 activities:
A2.1. Test Case selection and preprocessing
A2.2. Experimental validation of the architectural information recovery methods
A2.3. The development and integration of architectural compoments of the AReAS software tool prototype
A2.4. Validation of the integrated recovery technology of the architectural information from the source code
A2.5. AReAS software tool validation
A2.6. Results dissemination

Results:

Following results were obtained:

1. Development of methods for recovery of architectural information. This comprises: identifying the primary artifacts that must be considered for a successful recovery process and the relevant relationships between them, and development and synergic combination of the best algorithms and techniques from both the extractive and abstractive approaches.

2. Experimental validation of the methods for recovery of architectural information. This will also lead to creating a repository of test cases for architectural recovery from selected, analyzed and preprocessed relevant industry-size software systems, start a set of benchmarks for this domain.

3. Design, implementation and validation in the lab of the AReAS (Automated Recovery of Architectural Information from Source Code) tool and validation of the integrated AReAS technology for architectural recovery.

Applicability and transferability of the results:

As a result of this project, the AReAS (Automated Recovery of Architectural information from Source code) technology was advanced from TRL2 (technology concept formulated) at the beginning of the project to TRL4 (technology validated in the lab) at the end of the project. The project produced documented experimental results validating the proposed methods on extensive case studies. The project has built a prototype of the integrated AReAS tool, having the architectural design and main components integrated and functionally validated by applying the tool on a set of relevant industry-size software systems.

Financed through/by

This project was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, UEFISCDI, project number PN-III-P2-2.1-PED-2016-0999.

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Assist. Prof. Cosmin CERNAZANU, PhD
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EXPERIMENTAL ASSESSMENT OF A SELF-ADAPTIVE INTELLIGENT TRANSPORTATION SYSTEM

Goal of the project

At present, all attempts to optimize traffic flow completely ignore the fact that traffic has a predominant social footprint and would therefore potentially benefit from using specific tools to better understand its dynamics and predict its patterns (and thus introduce intelligence).
We therefore aim towards designing a distributed, hierarchical, self-adaptive decision-making that would respond quickly to traffic changes based on optimization carried over communities and superior estimation of its patterns.

Short description of the project

Our systems will: provide local optimizations, allow traffic lights to be networked, and provide global optimizations of traffic flow using decentralized, distributed control.

Project implemented by

Politehnica University Timișoara

Implementation period

Oct. 2017 – Dec. 2018

Main activities

- Collecting data for urban traffic flow by using semi-permanent sensors
- Modelling existing transport infrastructure with respect to measured traffic values
- Software implementation of algorithms described in Cristian Cosariu's PhD thesis
- Porting the bio-inspired algorithm corresponding to a single node to an embedded platform for implementation on a traffic controller
- Comparative simulation with a before-after analysis of the main quality indicators of the traffic
- High-level description for the architecture and communication framework for adjacent intersections
- Validation by simulation with special tools for the described protocol
- Extensive testing of the embedded platform under realistic operating conditions to achieve 1 year availability
- Participation to at least 2 international conferences

Results

- Development and online publication of the project's website
- Procurement of hardware and software required for the implementation of the project
- Technical documents with actual traffic values for road segments
- Architectural diagrams and specifications of proposed protocol with validation through simulation
- Source code and standard description of proposed methodology, available online on the project's website

Conference papers:

1. Gabriel Baban, Alexandru Iovanovici, Cristian Cosariu, Lucian Prodan.. Determination of the Critical Congestion Point in Urban Traffic Networks: A Case Study. 2017 IEEE 14th International Scientific Conference on Informatics, Poprad, Slovak Republic, November 14 - 16, 2017, doi 10.1109/informatics.2017.8327215.

2. Gabriel Baban, Alexandru Iovanovici, Cristian Cosariu, Lucian Prodan.. High Betweenness Nodes and Crowded Intersections: An Experimental Assessment by Means of Simulation. IEEE 12th International Symposium on Applied Computational Intelligence and Informatics (SACI 2018), May 17-19, 2018, Timisoara, Romania.

Applicability and transferability of the results

Our algorithm quickly reacts to traffic dynamics based on local heuristics. Real traffic situations simulated using the Vissim software showed a decrease in waiting times and queue lengths at local intersection level. The algorithm can be mapped efficiently onto embedded devices, current TRL-3 standing.
Our SIGS methodology recreates the road network by changing lane directions by using genetic algorithms and also has a current TRL-3 standing.
Intersections will exchange local traffic values and allow genetic algorithms to provide optimizations, which brings this at TRL-2. This will provide distributed, self-adaptive optimization of traffic.

Financed through/by

UEFISCDI PN-III-P2-2.1-PED-2016-1518, nr. 221PED/2017

Research centre

- Politehnica University Timişoara, Faculty of Automation and Computing
- Research Center in Computer and Information Technology (CCCTI)
- Advanced Computing Systems and Architectures Laboratory

Research team

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IMPROVING THE PREDICTION OF OPINION DYNAMICS IN TEMPORAL SOCIAL NETWORKS: MATHEMATICAL MODELING AND SIMULATION FRAMEWORK

Goal of the project

Improving the prediction of opinion distribution in a target society by means of topological analysis, temporal and spatial distribution of opinion sources, and real-time simulation on empirically gathered data. As such, we define the following individual objectives:
1) Topological analysis of empirical social network data to understand how interconnection patterns of individuals and communities influence the spread of opinion.
2) Development of an innovative social interaction model, inspired by previous original work, considering the temporal aspect of opinion sources.
3) Definition of a strategy for real-time opinion seed selection by means of node and edge centrality distribution.
4) Synergy of results from objectives 1-3 with direct applicative socio-economic impact by developing a crowdsourcing web-platform for voting and gathering anonymized empirical data from citizens.

Short description of the project

In the wake of big data analytics, this project sets out to push the boundaries of scientific understanding of opinion dynamics in social networks by analyzing how the underlying network topology influences communication patterns and the polarization of opinion.

Project implemented by

Assist. Prof. Alexandru TOPÎRCEANU – responsible for outlining the research goals, modeling of experiments, simulation and data validation, writing scientific manuscripts, overall project management.
Prof. Radu-Emil PRECUP – mentor for the project director, research goals, experiment modeling, revising scientific manuscripts.
Denis Nuțiu (4th year student) – web platform implementation.

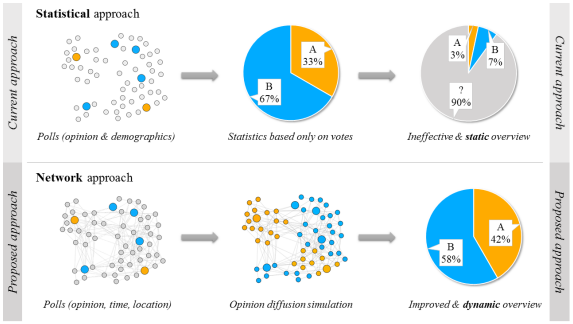
Implementation period

02.05.2018 – 30.11.2019 (19 months)

Main activities

This project comes to improve our understanding of opinion diffusion in emergent social networks. Consequently, to build models that are aware of these phenomena, we propose a topological analysis of empirical data using network motifs, community detection algorithms and statistics to understand the behavioral patterns and centralities which have an impact on the spatial and temporal distribution of opinion.

As opposed to most existing opinion interaction models, we propose a temporal opinion injection model which evolves over time according to basic human traits and underlying social topology.
Below is a schematic exemplifying the two different approaches considered.

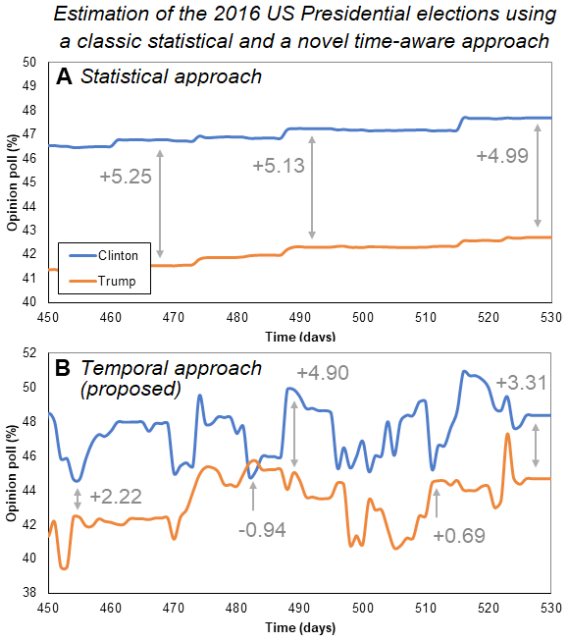


In the above figure we showcase the impact of the proposed project methodology in perspective to the current statistical approaches in opinion poll analysis and prediction. The statistical method relies solely on a small subset of individuals from which it tries to extrapolate overall opinion distribution; however, most of the opinion remains unknown (see gray pie chart in upper panel). Our proposed approach implies simulation of opinion propagation using more reliable scientific models and thus yields a more accurate perspective of opinion distribution (lower panel).

Results

We make use of temporal microscopic diffusion models to predict the macroscopic response of a target society being targeted by opinion injection. Our results pinpoint to the fact that time-awareness is more significant in poll prediction performance than previously considered.

Below, we exemplify a snapshot of the poll evolution calculated for the 2016 US presidential pre-election period. We provide snapshots of the final period before elections using cumulative counting (A), and our time-aware method (B) to estimate polls. Here, we exemplify the relative differences (Clinton--Trump) in polls at several time points.



For the 2012 US elections we can approximate the final poll results within a 2% margin, while current approaches produce much greater offsets of about 7%. Similarly, for the 2016 elections, our method (TA) manages to come within 1.5% of the real election results, while the current statistical approach (SA) remains outside the 4% margin. In terms of quantifying the overall performance boost of our method, compared to the benchmark methods, TA proves to be 75% more accurate for the 2012 elections, respectively 74% for estimating the 2016 elections.

As an explanation to why our TA method has a superior prediction capability is that, by taking into consideration the timing of pre-election opinion injection, TA captures the momentum of candidate popularity.

Applicability and transferability of the results

Current state of the art solutions for prediction, employed by respectable institutions in the US, like the *Huffington Post, Real Clear Politics, or Five Thirty Eight*, employ poll counting and combining polls with economic indices. Nevertheless, we have not seen any time-aware method that is similar to the one proposed by us in this project.

Consequently, we consider the framework developed in this project as very encouraging, and possibly opening a new line of research to further perfect our initial proposed method, which, to the best of our knowledge, is original and new. We hope to pave a new path of research targeting dynamic and temporal social network analysis, with immediate applicability in real-world systems where the needs for predictability and control are paramount.

Financed through/by

Romanian National Authority for Scientific Research and Innovation (UEFISCDI), project number PN-III-P1-1.1-PD-2016-0193

Research centre

- CCCTI: Research Centre for Computers and Information Technology (UPT)
- ACSA: Advanced computing systems and architectures research group

Research team

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Mentor – Prof. Radu-Emil PRECUP, PhD

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COMPREHENSIVE MONITORING METHODOLOGY FOR AGRICULTURAL LAND USE DYNAMIC CHANGES USING MULTISOURCE REMOTE SENSING DATA – AGRITELD

Goal of the project

The scientific study of agricultural lands is found in the specialty literature since the 1930s. These studies gradually turn from traditional studies (field investigations, field studies and then laboratory) to 3s spatially-based technology. The Integrated Approach to 3s Technology represents trends in precision farming. In this respect, in Europe and beyond, the factors responsible for the rational and sustainable management of agricultural land (governments) gradually achieve the importance of "remote" monitoring of agricultural lands and the importance of studying them globally.

Short description of the project

Information acquisitioned by remote sensing facilitate rapid and effective quantification of changes or advances a plant or several plants have encountered, their development phases and the basis for a new perception of research into precision farming.
Research and agricultural land monitoring using the benefits of remote sensing has developed a lot in recent years, but there are still unresolved issues related to: remote monitoring of a wide range of species (high variety), high accuracy, quasi-reality is still at the operating stage etc.

Information acquisitioned by remote sensing facilitate rapid and effective quantification of changes or advances a plant or several plants have encountered, their development phases and the basis for a new perception of research into precision farming.
Research and agricultural land monitoring using the benefits of remote sensing has developed a lot in recent years, but there are still unresolved issues related to: remote monitoring of a wide range of species (high variety), high accuracy, quasi-reality is still at the operating stage etc.

Project implemented by

Beneficiary:
Politehnica University Timișoara
Department: Overland Communication Ways, Foundations and Cadastral Survey
Partner:
Chinese Academy of Science
Institute of Remote Sensing and Digital Earth

Implementation period

June 2018 – December 2019

Main activities

Through the cooperation, we wish to form a systematic method to monitor the agricultural land use quickly and accurately, build up the remote sensing model of agricultural land use change assessment, prediction and spatial optimization. This could support centralized and orderly management of agricultural land, which provides scientific basis for agricultural land.
As originality and innovation elements following objective can be specified:
1. Developing multi-source remote sensing data fusion technology, and increasing the accuracy of land field determinations;
2. Developing a comprehensive monitoring technology based on multi-source remote sensing analysis of dynamic change of agricultural land use;
3. Establishing and validating an assessment, prediction and spatial optimization model of agricultural land use change using GIS facilities (Vilceanu, Herban and Meng 2017);

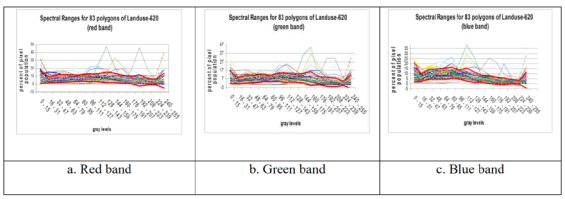

Fig. 1 GIS-Driven – Detectarea schimbărilor

There are several objectives standing before us. The cooperation in itself is a very positive goal as it opens each team to: other regions; different angles, view and facets of agricultural management; and different ways of thinking. More specifically, the cooperation proposed here between China and Romania is envisaged to help with introducing each other with the technology of monitoring and of land classification with high precision, as done at the other country.

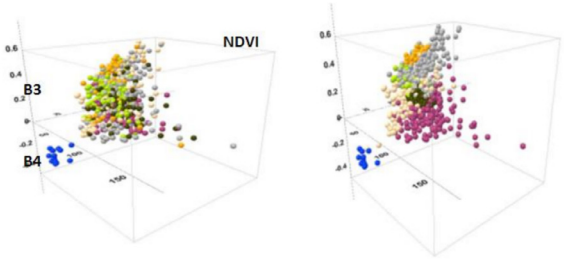

Fig. 2 IDA change detection and classification (left-before, right- after)

A secondary objective would be realizing better the usage of the spatial information embedded in the satellite images for the advancement of agricultural technology. The concept of GIS-Driven / GIS-support, mentioned above, is clearly one of the clear cut tools for such endeavour. In addition, both teams set some more specific goals:

- To learn the special characteristics of the satellite images provided by the Chinese cartographic satellite and any other products that will be provided for parallel processing.
- To establish the minimal resolution needed for the change detection and agricultural related classification at hand.
- To develop a modular concept of methodology that will support future adaptation to new satellite sources.

Results

- Developing a fusion technology of remote sensing data acquired from multiple sources;
- Developing a smart monitoring method based on dynamic changes of agricultural lands analysis from multiple sources of remote sensing;
- Establishing and validating an assessment, prediction and spatial optimization model of agricultural land use changes;
- Integrating spatial information in GIS platforms.

Applicability and transferability of the results

Applicability of the study its very various and useful for:

- Governments - implementing agricultural smart polities;
- small and large agricultural farms;
- another areas of research like forestry;
- etc..

Financed through/by

PN-III- Program: European and International Cooperation

Research Centre

Infrastructure for Construction and Transportation

Research team

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SOLAR LIGHT- ACTIVATED NANO-TIO2 DOPED WITH SILVER-COVERED ACTIVATED CARBON AND ZEOLITE BASED PHOTOCATALYTICALLY-ASSISTED FILTERING SYSTEM FOR WATER TREATMENT (WATICAZ)

Goal of the project:

The WATICAZ project scope is to develop an innovative water treatment unit characterized by enhanced performance consisted of the photocatalysis-assisted filtering system (PFS) as experimental demonstrator at laboratory scale for the treatment of real drinking water source. This system should exhibit the bifunctional adsorptive and photocatalytic characteristics that can be exploited either as filtering system with the possibility of solar photocatalytic regeneration (SPR) or as advanced oxidation unit to remove/degrade a large range of contaminants from water.

Short description of the project

The photocatalytic-assisted filtering unit using (doped)TiO_2-covered activated carbon/zeolite operated under UV/solar irradiation is developed.

Project implemented by

Partnership between Politehnica University Timișoara and National Institute for Research and Development for Electrochemistry and Condensed Matter

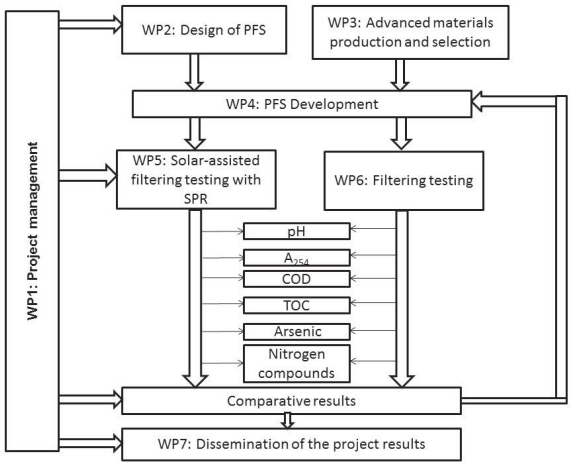
Implementation period

03.01.2017-29.06.2018

The main work packages and tasks are:

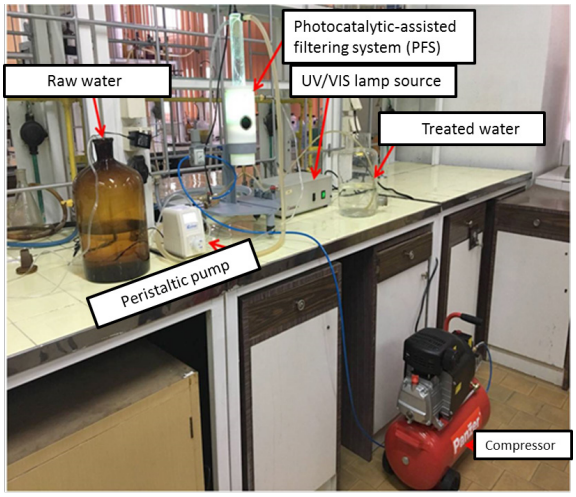
- Project management;
- Design of photocatalysis-assisted filtering system (PFS);
- Filtering materials production and selection *(Synthesis of the filtering materials characterized by the photocatalysis activity; Characterization of filtering materials by XRD, SEM, AFM, BET, DRUV-VIS)*;
- (Solar-assisted) filtering testing (with solar photocatalytic regeneration - SPR) *(Filtering column filling; Functional and operational testing of (solar irradiation photocatalysis-assisted) filtering system; Filtering material regeneration under solar irradiation; Morpho-structural characterization of materials after its usage; Validation by testing for the treatment of the real drinking water source)*;
- Dissemination of the results.

Main activities

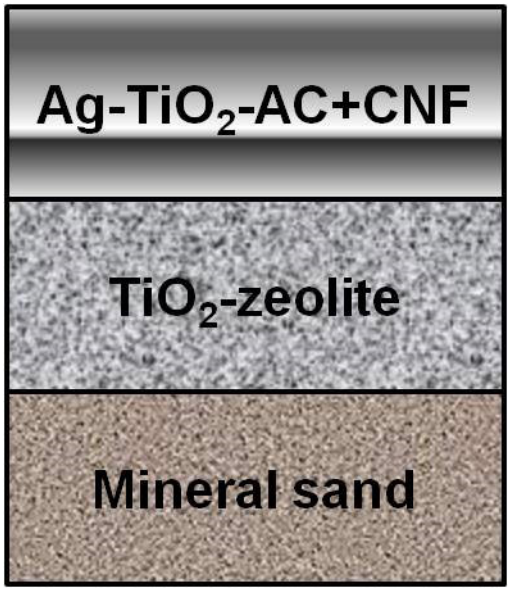


Project flow chart with work packages (WPs)

Results



Photocatalysis-assisted filtering unit



Layers of materials in filtering column

Applicability and transferability of the results

Drinking water and wastewater treatment plants

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)

Research Center

Research Center of Environmental Science and Engineering

Research team

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ADVANCED MATERIALS BASED ON COMBUSTION-SYNTHESIZED MAGNETIC IRON OXIDES NANOPARTICLES AND THEIR CYTOTOXICITY DESIGNED FOR CANCER TREATMENT

Goal of the project:

- Obtaining of magnetic iron oxides nanoparticles using the combustion synthesis method and monitoring the influence of several working parameters: fuel type (EDTA, citric acid, glucose), oxidant/fuel molar ratio (fuel-rich compositions), ignition procedure (heating mantle, microwave field), working atmosphere (in air/no air), carbon and organic residues presence.
- Preparation of colloidal suspensions.
- The assessment of the toxicological profile/biological activity of the iron oxide colloidal suspensions on normal/tumour liver and kidney cell lines.

Short description of the project

The project presents the preparation of iron oxides with via combustion synthesis and testing their selective cytotoxicity.

Project implemented by

Department of Applied Chemistry and Engineering of Inorganic Compounds and Environment,
Faculty of Industrial Chemistry and Environmental Engineering, Politehnica University Timișoara

Implementation period

July 2017-December 2019

Main activities

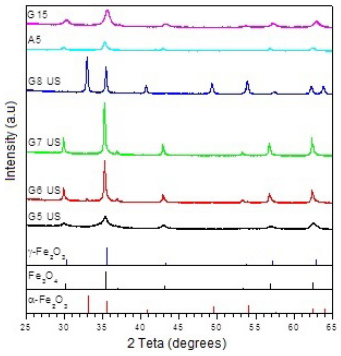
Combustion synthesis of magnetic iron oxides nanoparticles.
The influence of several parameters on the powders characteristics were pursued:

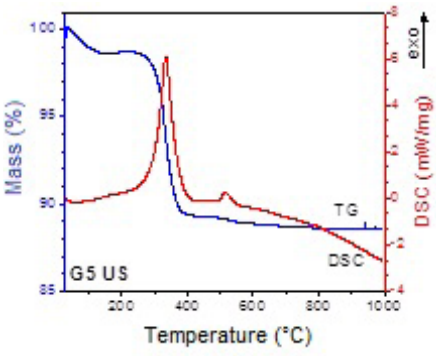
- nature of the fuel: glucose, citric acid, EDTA, TWEEN 80, hexamethylenetetramine
- reaction conditions: presence and absence of air
- carbon and organic residues presence and chemical oxidation removal using H_2O_2

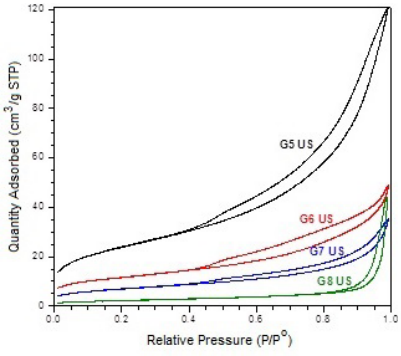
Characterization of magnetic iron oxides nanoparticles:

- combustion reactions evolution was assessed by TG-DSC thermal investigations
- the phase composition of the synthesized compounds was investigated by XRD
- specific surface area (BET)
- FTIR spectroscopy

The obtained results were centralized and interpreted for recipes optimization.







Results:

Synthesis protocols and recipes for 31 samples prepared by combustion synthesis. It was established the influence of different fuels (glucose, citric acid, EDTA, TWEEN 80, hexamethylenetetramine) and of the reaction conditions on the synthesis of iron oxides with magnetic properties.

Applicability and transferability of the results

These researches open an entirely new perspective on the potential use of combustion-synthesized iron oxide nanoparticles in cancer therapy by selective cytotoxicity.
The results will be subjected to a patent application.

Financed through/by

Ministery of Research and Innovation, CNCS - UEFISCDI,
project number
PN-III-P4-ID-PCE-2016-0765, within PNCDI III

Research Center

Research Centre for Inorganic Materials and Alternative Energies

Research team

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3. Robert Ianos - experienced researcher
4. Radu Lazau - experienced researcher
5. Dorina Coricovac - postdoc researcher
6. Alina Moaca - postdoc researcher
7. Roxana Babuta (Racoviceanu) - postdoc researcher
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INTEGRATED AND SUSTAINABLE PROCESSES FOR ENVIRONMENTAL CLEAN-UP, WASTEWATER REUSE AND WASTE VALORIZATION – SUSTENVPRO

Goal of the project

The goal of complex project SUSTENVPRO is to increase the institutional performance in the ENVIRONMENT field of a consortium of 5 public research organizations with recognized research performances and one R&D National Institute under consolidation, through an integrative approach which supports/develop the existent research competencies of each partner and transfer capacities of results with applicative and innovative potential envisaging the elimination of priority pollutants from water using innovative advanced water/ wastewater treatment processes and waste recovery.

Short description of the project

The complex project **SUSTENVPRO** consisted of 5 research component projects (PC):
PC 1. Complex evaluations of priority pollutants present in various water matrixes and risk identification on the ecosystems and human health;
PC 2. Water treatment processes optimization and development of innovative materials for the priority pollutants removal;
PC 3. Valorization of biomass resources for the development of innovative processes for wastewater treatment and priority pollutants removal;
PC 4. Metallic waste valorization for innovative wastewater treatment process development and removal of priority pollutants;
PC 5. Sustainability assessments of water/ wastewater treatment and waste valorization processes based on life cycle assessment.

Project implemented by

The project is implemented by 4 universities and two national R&D institutes:
Coordinator: "Gheorghe Asachi"Tehnical University of Iasi;
Partners: Politehnica University of Bucharest; "Alexandru Iona Cuza" University of Iasi; Politehnica University Timișoara; "Petru Poni" Institute of Macromolecular Chemistry Iasi; National Research and Development Institute for Environmental Protection, Bucharest.

Implementation period

2018 - 2020

Main activities

-Developing and validating an innovative approach oriented to analysis, preventing and correcting the environmental risks associated with the presence of priority pollutants in various matrices of water use;
-Development of efficient innovative water treatment and advanced wastewater treatment processes in order to eliminate priority organic and inorganic pollutants in the anthropic water cycle;
-Development of new innovative materials (polymeric or composite materials) with properties designed according to the characteristics of the priority pollutants;
-Utilization of materials from organic (biomass) and inorganic waste (metallic waste) in innovative wastewater treatment processes for removing priority pollutants and recirculating / reusing water;
- Sustainability assessment of processes and products through Life Cycle Assessment tool.

Results

-Research workplaces;
-New/significantly improved technologies /procedures;
-New/significantly improved research services;
-New research and technology consultancy services (uploaded on the ERRIS platform);
-Research services by sharing the research infrastructure among project partners (A1 and A2 research vouchers);
-Knowledge transfer to water operator through C voucher;
-Research papers published in ISI-ranked journals;
-Communications at national and international scientific events (conferences, exhibitions);
-Dissemination and technology transfer workshops;
-(Initiation /Intermediary /Final) Project workshops;
-RDI common program (in agreement with the institutional development plan of every partner).

Applicability and transferability of the results

- Transferability of research results between consortium partners;
- Technological transfer of advanced water/wastewater treatment technologies/procedures to public and private economic environment (regional water operators, environmental companies, private companies in the water/waste field etc.); knowledge transfer to regional water operator through C voucher within the project framework tested at pilot scale as treatability study for concrete applications in drinking water treatment;
- Good practice guide for circular economy in water field for sustainability consulting company, non-profit organization, environmental agencies.

Financed through/by

Executive Agency for Higher Education, Development and Innovation Funding (UEFISCDI)

Research centre

Research Centre in Environmental Science and Engineering

Research team

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RECYCLABLE MULTILAYER MAGNETIC BIOCATALYST FOR SYNTHESIS OF NATURAL ESTERS

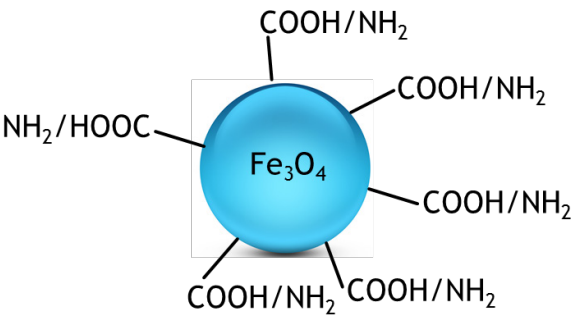
Goal of the project:

The main goal of the project is to develop a demonstration model for a new biocatalyst containing a designed magnetic core and hybrid layers (organic and silica) that allow the immobilization of enzymes. The validation of the model will be accomplished through the effectiveness of the product in a specific reaction, to demonstrate that such a biocatalyst is stable, reproducible, recyclable and able to synthesize esters that are accepted as naturals according to the EC regulations (Regulation no 1334/2008 of the European Parliament and subsequent amendments).

Short description of the project

The key objective is a comprehensive evaluation of the magnetic manipulation efficiency of enzyme functionalized magnetic nanocomposites obtained by applying cost-effective preparation procedures and manifold advanced characterization and testing techniques. The chemical composition, structure, size distribution, magneto- responsiveness and size, as well as the enzyme loading capability will be designed to fulfill the requirements for efficient biocatalysis and easy recovery of the enzyme even from viscous media, avoiding the contamination of the product and allowing its recognition as "food-grade".

An innovative multilayer technology will accomplish the demonstrative model. The immobilization of lipase on controlled-size magnetic core nanoparticles will be combined with stabilization of the hybrid composite through a sol-gel silica shell. The size and magnetic properties of the core particles will be adjusted to allow the optimal catalytic efficiency.



Project implemented by

- Politehnica University Timişoara-Project leader
- National Institute for Research and Development of Isotopic and Molecular Technologies INCDTIM Cluj-Napoca - Project partner

Implementation period

30.01.2017- 29.06.2018

Main activities

The objective of the project is to develop a demonstration model for a new biocatalyst containing a designed magnetic core and hybrid layers (organic and silicon) that allow the immobilization of enzymes, as well as the validation of the model through its effectiveness in a specific reaction of aroma ester synthesis.

Stage 1 (2017, 12 months) – Development of a new multilayer magnetic biocatalyst

Stage 2 (2017, 12 month) – Synthesis of natural esters in repeated cycles using the multilayer magnetic biocatalyst

Results

The research carried out in this stage was focused on:

- development of a new multilayer magnetic catalyst by preparation of various magnetic nanoparticles;
- immobilization studies of *Candida antarctica* B lipase on these supports;
- investigation of the resulted biocatalysts in esterification reactions.

Magnetic clusters functionalized with amino and carboxyl groups were obtained, and their structural, morphological and their magnetic characteristics were determined by instrumental methods, like as XPS spectroscopy. A second direction was the production of single-core magnetic nanoparticles stabilized by coating with various surfactants. These nanoparticles were thoroughly characterized by FT-IR, TEM, and XPS.

For both multi-core and single-core magnetic particles, the hydrodynamic diameters and zeta potential values have been also determined. The investigations concerning lipase immobilization included the influence of the nature and concentration of the binding agent (carbodiimide or glutaraldehyde), as well as finding of the optimal reaction conditions for covalent binding. The hydrolytic and esterification activities of the obtained biocatalysts were assayed on standard substrates.
Visit also: http://chim.upt.ro/ro/cercetare/proiecte-de-cercetare/247-pn-iii-p2-2-1-ped-2016-0168

Publications in the field of the project:

1. A. Nan, I.V. Ganea, R. Turcu, Physicochemical properties of a new magnetic nanostructure based on poly(benzofurane-co-arylacetic acid), *Analytical Letters*, accepted, DOI: 10.1080/00032719.2017.1400041
2. A. Todea, D. Aparaschivei, V. Badea, C.G. Boeriu, F. Peter, Biocatalytic route for the synthesis of oligoesters of hydroxy-fatty acids and ε-caprolactone *Biotechnology Journal*, 2018, accepted.

Presentations at conferences:

1. R. Turcu, C. Vasilescu, A. Nan, T. Radu, I. Crăciunescu, A. Petran, M. Cîrcu, A. Bunge, F. Peter, Magnetic nanostructures with functional coating specifically designed for immobilization of enzymes, *2nd World Congress & Expo on Materials Science and Nanoscience*, September 25-27, Valencia, Spain.
2. C. Vasilescu, I. Benea, C. Paul, A. Todea, R. Turcu, F. Peter, Immobilization of lipase from *Candida antarctica* B by covalent binding onto magnetic supports, *New Trends and Strategies in the Chemistry of Advanced Materials with Relevance in Biological Systems, Technique and Environmental Protection*, 10th Edition, June 08-09, 2017, Timișoara, Romania.

Applicability and transferability of the results

This custom-made immobilized lipase will be able to catalyze the synthesis of natural esters from natural acids and natural alcohols. There is a high demand for food aroma esters recognized as naturals and the biocatalytic way is the best possibility to synthesize them. Superparamagnetic iron oxide nanoparticles (IONPs) in highly stable ferrofluid formulations will be used to fabricate functionalized magneto-responsive nanobeads for lipase immobilization, resulting in manifold reusable nanoparticle systems of high catalytic efficiency.

Financed through/by

Romanian Authority for Scientific Research and Innovation (UEFISCDI), project number PN-III-P2-2.1-PED-2016-0168, within PNCDI III

Research Center

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research team

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Dr. Oana MARINICĂ
Iulia PĂUȘESCU, PhD
Chem. Diana APARASCHIVEI (PhD student)
Chem. Corina VASILESCU (PhD student)
Biol. Horațiu MOLDOVAN (PhD student)

Partner: National Institute for Research and Development of Isotopic and Molecular Technologies INCDTIM Cluj-Napoca
Responsible: Dr. Rodica TURCU
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Dr. Monica CIRCU
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ENERGY EFFICIENCY THROUGH AIR JETS ENERGY RECOVERY FROM EXHAUST SYSTEMS AT S.C. CLAGI-COPLASS S.R.L.

Goal of the project

The project objective was focused on the climate change and energy consumption reduction issue through knowledge transfer to industry applications, based on the scientific and research activity of team members. Energy loss recovery measures applied to S.C. CLAGI COPLASS S.R.L. have contributed to the reduction of energy consumption.

Short description of the project

Reducing energy consumption by recovering the energy exhausted into the atmosphere by the exhaust systems.

Project implemented by

The project was implemented by the Politehnica University Timi;oara at S.C. CLAGI COPLASS S.R.L.

Implementation period

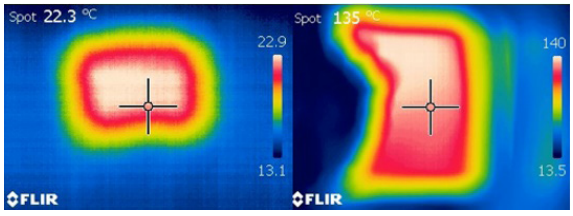
01.10.2016 - 01.10.2018

Main activities

The activities were structured in three stages, as it follows:

Stage I - Preparation, installation, and monitoring - Within this stage, a database of energy consumptions was developed and for a group of 10 students an internship program was organized.

Stage II - Analysis and implementation of the optimal system - At this stage there were identified the sources with energy recoverable potential (thermographs and measurement of air jets velocities)- Figure 1-and recuperative solutions were implemented.



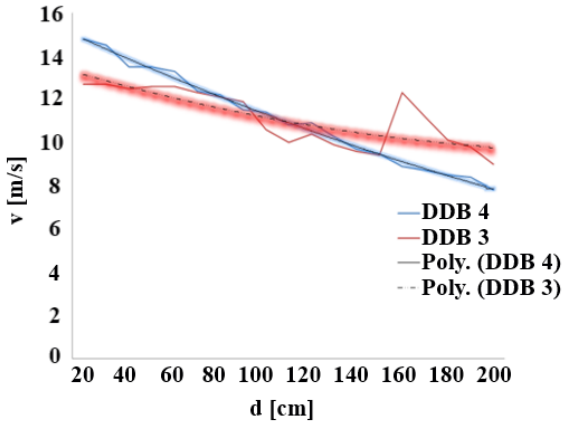


Figure 1

Stage III - Analysis and optimization - At this stage the optimal solution was analyzed, followed by the monitoring of the input / output parameters in order to establish the reduction of energy consumption at S.C. CLAGI COPLASS S.R.L. (Figure 2). The obtained results were validated by the economic agent.

Figure 2

Results

The implementation of the proposed system has led to the optimization of installations for the industrial technological equipment such as dyeing / drying booths (DDB), and savings due to the energy consumption reduction (Figure 3).

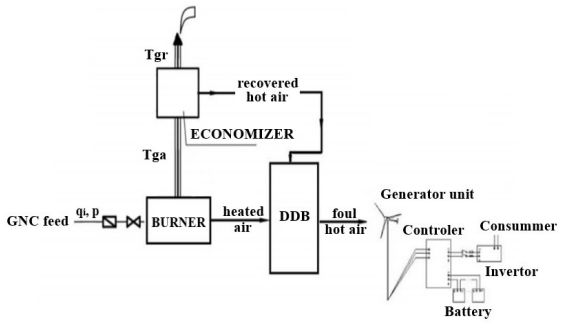


Figure 3

The technological improvement of the industrial technological equipment is an important factor for the economic agent to acquire new technical knowledge and increase the productivity. The members of the research team and the students / master students participating in the internship program have acquired entrepreneurial knowledge and skills.

The most significant result is the recovery of the quantified lost energy by reducing energy consumption (Figure 4) and, finally, the reduction of greenhouse gas emissions.

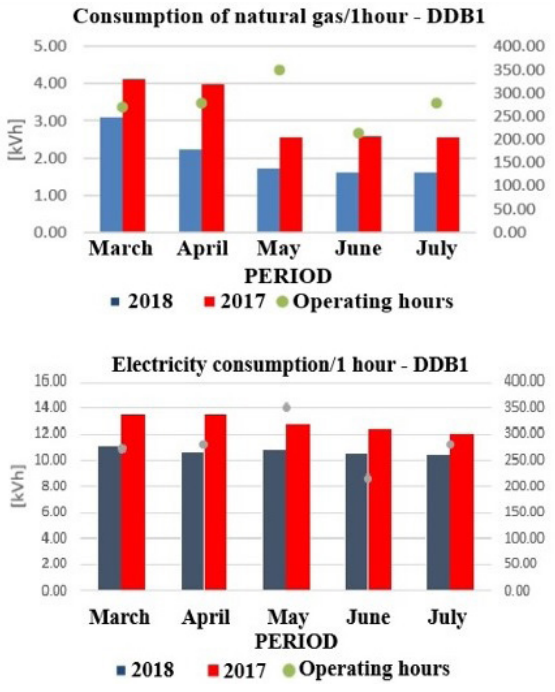


Figure 4

The scientific work impact of the research team members has been materialized through the publication of the research results in ISI / BDI indexed journals / conferences.

Applicability and transferability of the results

Energy efficiency measurements, by addressing one-off solutions, have led to the energy consumption reduction and, implicitly, to lower production costs at the economic agent. By implementing the project, collaboration between the partners involved has been developed. The economic agent can extend the solution applicability to all technological endowments. Energy efficiency solutions can be extended and can have a multiplier effect for the industrial sector that has similar technological equipment.

Financed through/by

Financed through PNCDI III - Program 2, Subprogram 2.1 – Transfer of knowledge to the economic agent „Bridge Grant"/ by UEFISCDI

Research Centre

Research Centre for Building Services Engineering (RCBSE)

Research team

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EXPERIMENTAL VALIDATION OF THE RESPONSE OF A FULL SCALE FRAME BUILDING SUBJECTED TO BLAST LOAD - FRAMEBLAST

Goal of the project

The main goal of the FRAMEBLAST project is to provide an accurate validation of the response of a full scale building structural frame system under internal and external blasts in laboratory environment. The structure is subjected to internal and external blasts from different charge weights and locations (standoff, height above ground), resulting in different loading scenarios.

Short description of the project

Explosions produced in urban areas by the detonation of high explosives are low-probability, but high-risk events. When they occur in the immediate vicinity of buildings, the explosions can affect their structural integrity (local/global failure) and harm people (injuries, death). Because the blast threat can only be mitigated, the risk can be reduced by reducing the exposure and vulnerability (enhanced local strength, allow the development of alternate load paths to prevent progressive collapse).

Project implemented by

The project is implemented by a partnership between POLITEHNICA UNIVERSITY TIMIȘOARA, project coordinator Professor Florea Dinu and NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN MINE SAFETY AND PROTECTION TO EXPLOSION INSEMEX Petrosani, represented by dr.ing. Attila Kovacs. External experts from TECHNICAL UNIVERSITY of CLUJ-NAPOCA and URBAN-INCERC Cluj-Napoca are also involved.

Implementation period

2017-2018

Main activities

- Preliminary analysis, design and fabrication of full scale experimental model
- Experimental tests on full-scale building model under internal blast. Explosive charges are detonated in different locations to acquire information about blast pressure decay and interaction with the structure
- Experimental tests on full-scale building model under external blast. First explosive charges are detonated in different locations to acquire information about blast pressure decay and interaction with the structure. Second test series use increasing explosive charges (charge weight / standoff distance) to cause the column in proximity to fail.
- Validation of a numerical model using Extreme Loading for Structures (Applied Science International, LLC, ASI).
- The development of a procedure to apply structural identification to components of a full-scale building structure with structural damage resulting from the blast pressure.

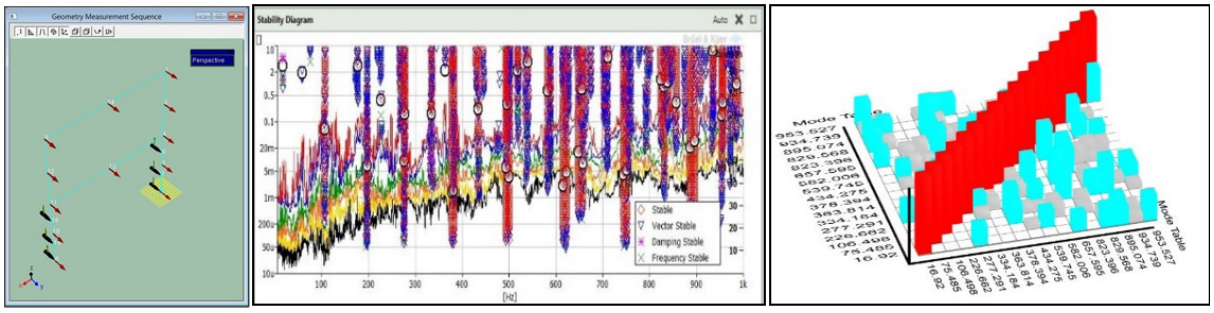
Results

1. Construction phase
- The structure components were brought to the construction site and assembled on-site using bolted connections
- Preliminary internal blast testing were performed using small charge weights (121 g cartridge of explosive)

a) b) c)

Fig. 1 Views with the experimental model:
a) general view; b) view from inside with the position of a test blast charge; c) detailed view of a connection.

2. Experimental modal analysis to assess the dynamic properties of the structure (Bruel & Kjaer vibration measurement technology and equipment
- Experimental modal analyses (EMA) were carried out using hammer excitation and 11 accelerometers
- The modal parameters were verified using the Modal Assurance Criterion (MAC)



a) b) c)

Fig. 2 Modal parameter identification: a) position of the accelerometers and MTC hammer; b) stability diagram; c) modal assurance criterion MAC

3. Preliminary numerical testing using models calibrated against bunker tests
- Blast tests performed on two identical 3D specimen were extracted from a typical moment resisting steel frame structure
- They allowed to make a preliminary calibration of the numerical model of a full scale building structural frame system
- Numerical simulations were performed to evaluate the consequences of close-in detonations on the structural elements

a) b) c) d)

Fig. 3 Numerical simulations using ELS:
a) 3D view of the model tested against external blast; b) relevant blast test inside bunker; c) - d) simulation of local damage for two blast loads

Applicability and transferability of the results

- Experimental validation of an integrated building system in laboratory environment represents the bridge from the scientific research to practical application (structural engineering).
- Experimental database and numerical models are used to upgrade the existing codes for structural design and prevention measures

Financed through/by

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2016-0962, within PNCDI III: "Experimental validation of the response of a full-scale frame building subjected to blast load" - FRAMEBLAST (2017-2018).

Research Centre

The Research Center for Mechanics of Materials and Structural Safety - CEMSIG

Research Team

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FAST WELDING COLD-FORMED STEEL BEAMS OF CORRUGATED SHEET WEB (WELLFORMED)

Goal of the project

The main aim of the project is to test and validate a NEW technological solution for built-up cold-formed steel beams (CWB), with corrugated sheet webs and built-up cold-formed steel flanges, using Spot welding (SW) or Cold Metal Transfer (CMT) connecting technologies.

Short description of the project

The advances in cold-formed steel structures require not only material savings but also high efficiency of production and manpower reduction. The WELLFORMED research project proposes to study a new technological solution for built-up beams made of corrugated steel sheets for the web and thin-walled cold-formed steel profiles for the flanges, connected by SW or CMT welding. Within the research project, the experimental work includes tensile-shear tests on the lap joint spot-welded specimens, were different combinations of steel sheets with various thicknesses were tested and, tests on full scale beams in bending. The study intends to demonstrate the feasibility of the proposed solutions, to assess their performance and to enlarge the knowledge by using numerical simulations for the optimization of the current solution and to define the limits of applicability of the solution.

Project implemented by

CEMSIG - The Research Center for Mechanics of Materials and Structural Safety - Research and Technical Development unit of Politehnica University Timișoara, at the Faculty of Civil Engineering, Department of Steel Structures and Structural Mechanics.

Implementation period

03.01.2017-02.07.2018

Main activities

- design and fabrication of experimental program;
- experimental program on welded connections (SW and CMT) and optimisation of fastening technology;
- experimental program on full scale CWB beams, using SW or CMT connecting technologies;
- numerical investigation of beams and parametric investigations:
  - calibration of numerical models by experimental tests;
  - optimization of technical solutions;
  - design and numerical analysis of specimens with larger spans;
- design guidelines and recommendations for fabrication.

Results

- experimental results on tensile-shear tests on the lap joint spot-welded and CMT specimens (280 small specimens), were different combinations of steel sheets with various thicknesses were tested;
- experimental program on 5 full scale CWB beams, 2 using SW and 3 CMT connecting technologies.

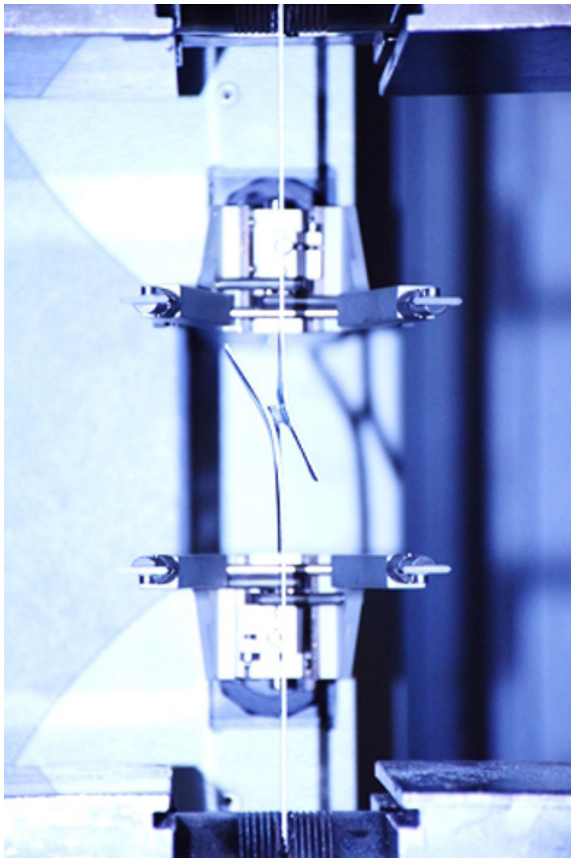

Fig. 1: Full button pull-out failure mode

Fig. 2: SW1 CWB Beam during the test

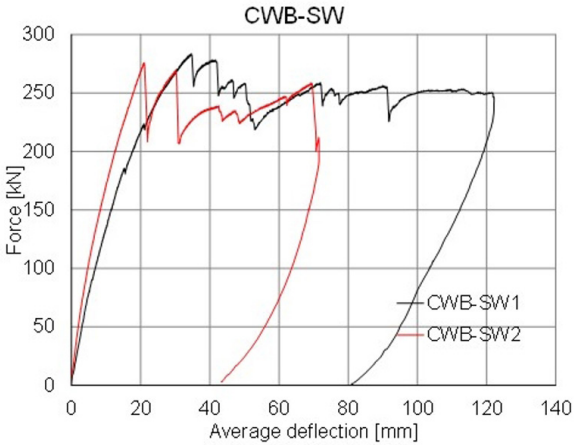

Fig. 3: Force-deflection curve for the full scale built-up beams

Applicability and transferability of the results

The new technical solution is composed of 100% of cold-formed steel components, having high protection to corrosion, due to the fact that all components are galvanised. The solution allows for easy prefabrication, reduced erection time, mass production and high-precision quality control. All of these characteristics are expected to be interesting both for manufacturers and contractors, making steel competitive. Design guidelines and recommendations for fabrication will be provided.

Financed through/by

The project is supported by a grant of the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), grant agreement 57PED/2017.

Research centre

Research Center for Mechanics of Materials and Structural Safety (CEMSIG)

Research team

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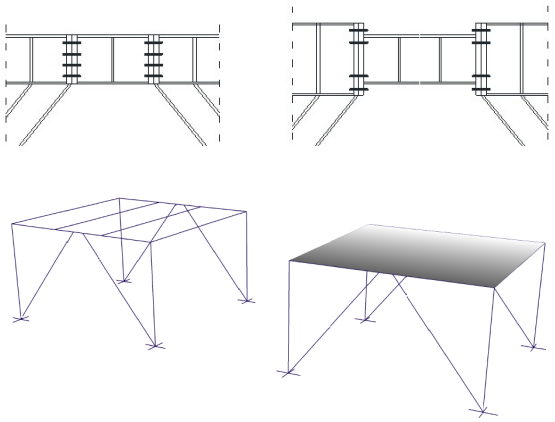
ADVANCING RE-CENTRING ECCENTRICALLY BRACED FRAMES: NEW LINK TYPOLOGIES AND INFLUENCE OF REINFORCED CONCRETE SLAB (ARNIS)

Goal of the project

To reduce the costs and downtime of a structure hit by an earthquake, removable links and re-centering capacity concepts may be implemented in a dual eccentrically braced structure. The project aims at extending the validation of re-centering capability and link replacement feasibility on extended end-plate typologies and also investigate more detailed the global and local influence of three-dimensional reinforced concrete slab panels, as well as reinforced concrete slab repair.

Short description of the project

It studies the re-centering capability using new link typologies and the concrete slab influence.



Project implemented by

Politehnica University Timișoara (UPT) – Civil Engineering Faculty – Steel Structures and Structural Mechanics Department

Implementation period

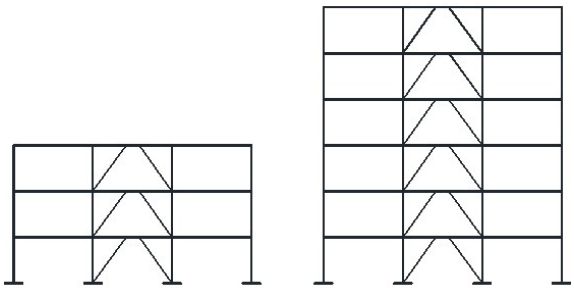
10.10.2018 – 09.10.2020

Main activities

- Designing prototype structures with two height levels: medium rise (P+2E) and higher rise (P+5E), with differently connected links (flush/extended end-plate), extending the bolted links removal procedure and re-centering capability – done in 2018;
- Experimentally testing isolated links assemblies in two solutions: flush end-plate bolted link and extended end-plate bolted link, at natural scale (1:1), both of them with and without concrete slab above the link (8 tests) – proposed for 2019;
- Experimentally testing a 3D portal frame, with/without concrete, with damaged/repaired slab (4 tests) – proposed for 2020;
- Calibrating numerical models post-test – proposed for 2019 and 2020;
- Seismic performance and behavior factors numerical assessment – proposed for 2020.

Results

In 2018 – prototype structures design, re-centering capability validation and link removal procedure description.



Proposed for 2019 and 2020:
- Design of experimental specimens;
- Material behavior curves;
- Links experimental results – describe local behavior;
- Frames experimental results – describe global behavior;
- Calibrated numerical models for links;
- Values of behavior factors for structures.

Obtained results will be presented in project deliverables and scientific papers at international conferences/journals.

Applicability and transferability of the results

Increase the application potential of the system both at national and international levels: by improved connections (larger behavior factor obtained), improved knowledge on the effect of reinforced concrete slab and repair of the slab.
Solutions providing self-centering of the structure are technically demanded and require specialized knowledge, careful maintenance and high initial cost. Alternatively, a conventional design can be employed, but with the dissipative members realized to be removable allowing their replacement when damaged and reducing the repair costs.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)

Research centre

Research Centre for Mechanics of Materials and Structural Safety - CEMSIG

Research team

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TESS - THERMO-ELECTRIC HYBRID SOLAR SYSTEM

Goal of the project

The project relates to a solar thermal - electric hybrid, which produces hot water and electricity using thermoelectric modules.

Short description of the project

The system is composed of thermoelectric modules, and solar concentrator photovoltaic cells that convert heat to increase efficiency and reduce losses by convection, using a vacuum chamber that allows the positioning unit conversion at any position and allows adjusting the amount wastewater heat transferred by replacing hexagonal mirror solar concentrator photovoltaic.

Project implemented by

Department of Applied Electronics, Politehnica University Timișoara

Implementation period

03.01.2017 – 31.03.2018

Main activities

Mechanical system implementation
Full working prototype
Experimental validation
Final stage

Results

- 2 published Journal papers (Thomson Reuters WoS) IF>1.5, Q2 and Q3
- 2 ISI Journal papers (under review)
- 8 ISI conference papers
- 2 patents

Applicability and transferability of the results

- Effective solution for domestic use
- Tool for complex modeling, simulation and measurement
- Real time flow control

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania.(UEFISCDI), PN-III-P2-2.1-PED-2016-0074, 499.700 RON (110.800 EUR)

Research centre

Intelligent Electronic Systems, http://www.ccesi.etc.upt.ro/

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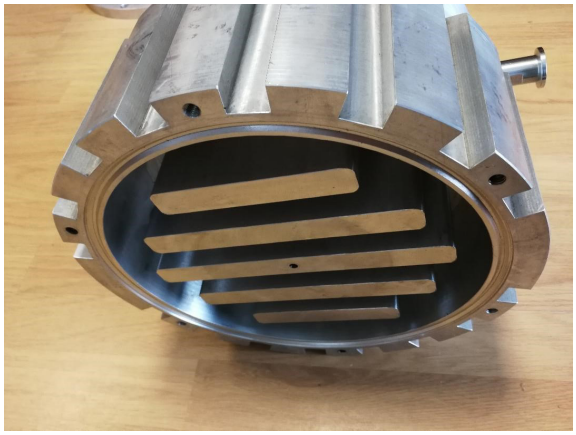

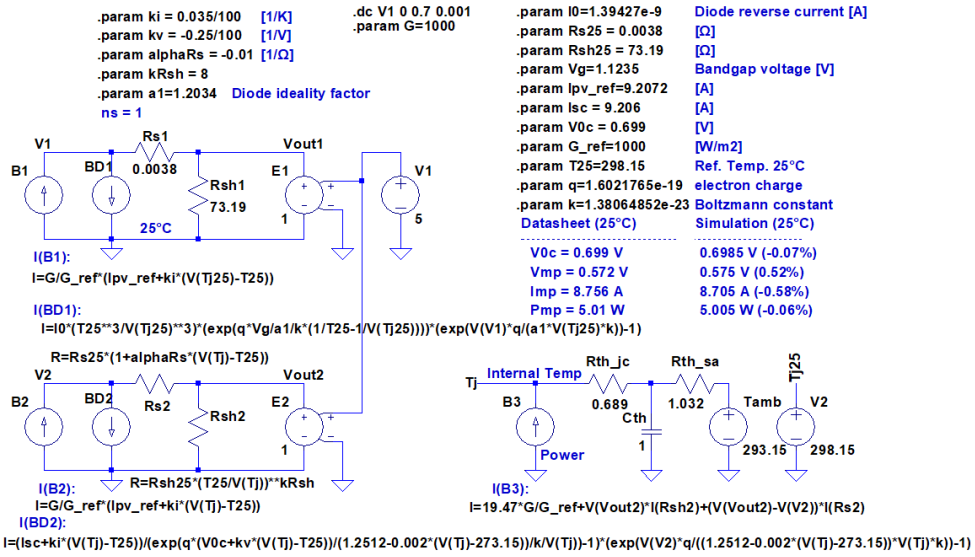

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DUAL STATOR WINDING INDUCTION GENERATOR SYSTEM FOR WIDE-VARIABLE SPEED WIND POWER APPLICATION (DSWIG)

Goal of the project:

For wind power plants, the cage-type induction generator (IG), as a competent option, has many advantages for wind power applications, such as innate brushless construction, low maintenance demand, good overload protection ability, and so on. The most significant advantages of this machine lie in its ability to output good performance electric power at variable rotor speeds. To adapt the wide variation of wind speed and capture much more wind energy, the wind power system should have the variable-speed operation ability in a wide speed range.

Short description of the project:

The subject of the bilateral project, which relates to a wind power system with a dual stator-winding induction generator.

Project implemented by

Politehnica University Timisoara (UPT) - România
Nanjing University of Aeronautics and Astronautics (NUAA) - China

Implementation period:

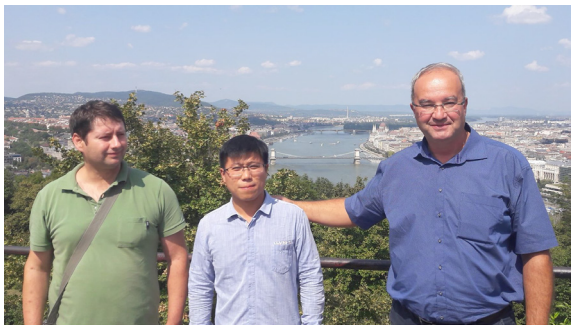
02.07.2018-31.12.2019

Main activities:

The basic priority of the collaboration is the development of a scientific project for participation in competitions announced by Horizon 2020 and other international programs. The work plan proposed is based on regular meetings of the members of both teams alternately in Romania and China; a) a first visit will be in China, by a team from Romania. On this occasion the Romanian members will meet all the team members from China, will visit research labs; b) the next meeting will take place in Romania, at Timișoara at the Faculty of Electrical and Power Engineering, at the Romanian Academy Branch Timișoara and at the Hunedoara Engineering Faculty. On this occasion contact will be established with all members of the project team from Romania, visits will be carried out to the research laboratories of the two faculties, and there will be group discussions between members of both teams according to scientific areas of joint research.

Results:

The results for the Year 2018 are:
Between July 2 and December 31, 2018, was carried out on the topic of DSWIG Generator Design. At this stage, the Romanian team carried out the following activities: dimensioning of the experimental model, analytical design, optimal design, finite element validation, design of the electric drive system and the experimental test bench. Between August 26 and 30, 2018, a team (Deaconu Sorin Ioan, Topor Marcel and Hulea Dan Cornel) from the Politehnica University Timisoara (UPT), made a trip to Budapest where he attended the IEEE International Conference on Power Electronics and Motion Control (PEMC), where they met a team from the Nanjing University of Aeronautics and Astronautics, China, led by BU Feifei, project director from the Chinese team.



Applicability and transferability of the results:

The results obtained through this project are of interest to the industry of the construction of electrical machinery, renewable energy converters, wind systems, hydro systems, and producers of autonomous generators for vehicles, boats, river and sea vessels, and aircrafts. Based on the project developed by the team in Romania, the Chinese team will realize the experimental model and its control system. Following experimental testing, parameters and features will be obtained, and based on them, a Chinese producer will be identified to introduce these systems into production.

Financed through/by

Executive Agency for Higher Education Research, Development and Innovation Funding (UEFISCDI)

Research Center

Inteligent Control of Energy Conversion and Storage

Research team

The research team of UPT consists in coordinator,
Associate professor Sorin Ioan DEACONU, PhD
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Nicolae MUNTEAN,
Lucian Nicolae TUTELEA,
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PERFORMANT POWER TRAIN FOR HYBRID AND ELECTRIC VEHICLES WITH DUAL ROTOR SINGLE STATOR AXIAL SYNCHRONOUS MACHINE AND SINGLE INVERTER - HELSAX

Goal of the project:

The project goal of bilateral cooperation between the UPT-TUIASI and UTM proposed, is of major scientific and practical importance in reducing pollution from vehicles classic using hybrid vehicles or electric drive systems performance, and aims to develop and enhance knowledge of joint research teams from Romania and Moldova, as well as enhance mobility of researchers, exchange of experience and mutual access to research infrastructure of medium and high scale, existing in the three universities.
The basic priority of the collaboration is to develop, during the implementation of the joint project, of a scientific project for participation in competitions announced by Horizon 2020 of the European Union and other international programs.

Short description of the project:

It proposes an international original solution in which the two electrical machines (generator and motor) and static converters related are replaced by a single synchronous permanent magnet machine having axial air gap, a central stator with slotes on both sides and two different windings supplied from a single PWM inverter having two output frequencies, and two independent rotors.

Project implemented by

Politehnica University Timișoara (UPT),
Technical University "Gheorghe Asachi" Iaşi (TUIASI) and
Technical University of Moldova (UTM)

Implementation period:

September 2016 – March 2018

Main activities:

The aim is to exploit the potential of joint research of the two teams for creating a system of electric drives for hybrid vehicles and electrical overall dimensions and low weight; reduce carbon emissions from vehicles; have a static converter that is simple and inexpensive; broadcast transmission system using differential electric vehicles; control of the two rotors so that they can operate in the same mode or in different modes at the same rotational direction or in opposite directions at the same speed value at slightly different speeds or at much different speeds. Specific objectives: increasing electrification of the vehicle; reducing vehicle weight; increasing the speed of operation of the electrical machine rotors for reducing the size of the actuator; sizing model for which the design (impose conditions of power, size, weight); design model for the electric drive system and the stand of experimental tests; increasing efficiency for the electric drive system; the practical design of the machine, inverter and battery accumulators; exhibition experimental test setup; implementation and testing of the various experimental control solutions; creating an intelligent system for managing production and electricity consumption per vehicle. Expected results: a much easier vehicle with an electric drive system; low inertia rotor at high speeds; a compact electric drive system with high torque and simple control; an inverter that manages various operation modes with different speeds equal to or in the same direction or in opposite directions of the two rotors.

Results:

The work plan in 2016 was based on regular meetings of members of both teams alternately in Romania and Moldova. First visit was in Moldova, by a team from Romania. On this occasion the Romanian members met the team members from Moldova, visited research labs, they did contact with their scientific concerns. During this movement, a conference occurred, in order to launch the project in Chisinau, where teachers and students from the Technical University of Moldova and specialists in electrical engineering enterprises in Chisinau, Balți and Tiraspol were invited .
Then followed a visit by a team from UTM to Faculty of Electrical Engineering and Energetics in Timisoara and the Faculty of Engineering Hunedoara. On this occasion contact were established with all members of the project team from Romania, were visited research laboratories of the two faculties, and there was group discussions between members of both teams according to scientific areas of joint research. One conference was organized in order to launch the project in Timisoara, where teachers and students at the University Politehnica Timisoara and specialists of enterprises of Timisoara and Arad with automotive profile were invited. There was a travel team from Chisinau to visit industrial companies in the automotive industry in Hunedoara and Deva (Lisa Draexlmaier Hunedoara, Sews Deva).

Applicability and transferability of the results:

The motors excited by permanent magnets in a variety of designs, gaining more ground in the competition with the DC classics, because of high technical and economic achievements, especially under current conditions, in association with improved electronic supply sources and assisted computer systems that are more and more competitive. Obtaining reasonable torque values for a wide range of variation of speed, drive systems through simple procedures, are no longer a difficulty that cannot be solved. Using motors excited by permanent magnets and brushless fractional number of slots per pole and phase engines in particular, as actuators in servo-drives for low power and area, has expanded compared to the classic DC due to the progress of power electronics and information technology, without which one can not conceive an elastic system containing modern drive controllable speeds in wide range. With integrated systems for the electric drive, having adequate topologies actuators as execution elements , through the use of more evolved control algorithms and integrating functionality at both hardware and software, may lead to dynamic and superior performances, more precise control of speed or position, high electromagnetic torque, higher energy efficiency and high accuracy while simultaneously reducing overall system cost consistently. The project results will contribute to community social objectives to combat climate change. The main contribution is to reduce emissions of CO2 and emissions of greenhouse gases. The project proposes new technologies and contributes to sustainable economic development.

Financed through/by

UEFISCDI

Research Center

UPT members of the research team are also members of the University's two research centers: the Institute for Renewable Energy and Research Centre for the intelligent control of power conversion and storage.

Research team

The research team consists of UPT coordinator Assoc. Prof. Sorin Ioan DEACONU,PhD, teachers (PhD's): Nicolae MUNTEAN, Lucian Nicolae TUTELEA, Liviu MIHON, Octavian CORNEA, Ciprian ŞORÂNDARU, Marcel TOPOR, engineers and PhD students: Loredana GHIORMEZ and Csaba GHEORGHIU.

Informbusiness Chişinău laboratory for experimental work.

Helsax project launch conference in Chisinau.

Helsax project launch conference in Hunedoara.

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INTELLIGENT SYSTEM FOR AUTOMATIC DIAGNOSIS OF THE CONTACT LINE OF ELECTRIC RAIL TRANSPORT

Goal of the project:

The project provide an intelligent system for determining the actual state of the contact line (CL) and performing maintenance working on the basis of data generated by this system. To this end, a pantograph-draisine existing, used for maintenance, was be equipped with an automatic system for measuring the technical parameters of CL. An expert system analyzes measured data and provide two kinds of decisions: urgent intervention points, and predictions on future developments in the CL state.

Short description of the project

Measurement of geometric parameters will be done with a video-camera and a laser distance sensor.

Project implemented by

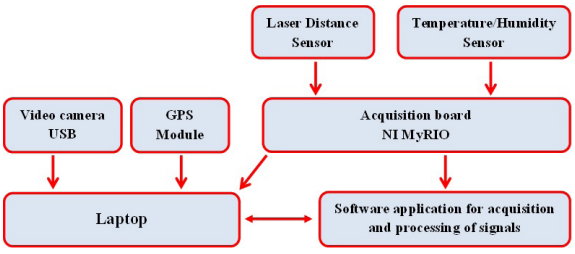
- Politehnica University Timișoara and S.C. Electrificare C.F.R. S.A. Bucharest

Implementation period

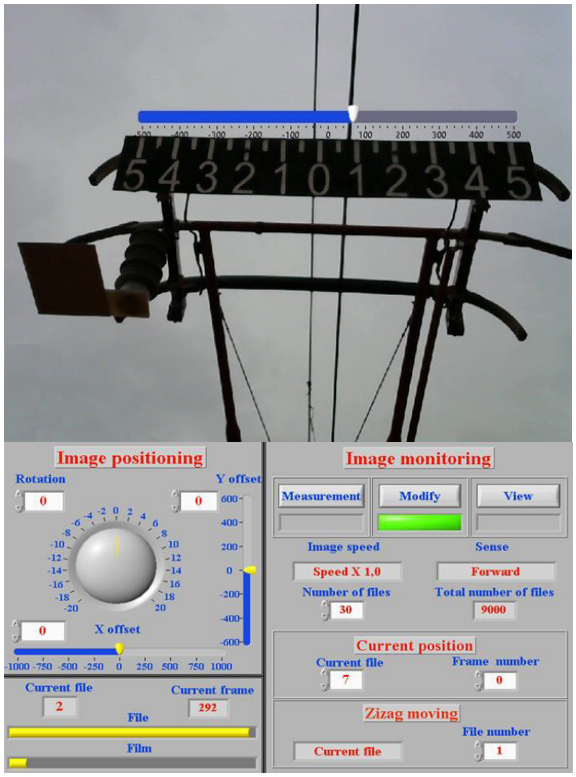
30.09.2016-30.09.2018

Main activities

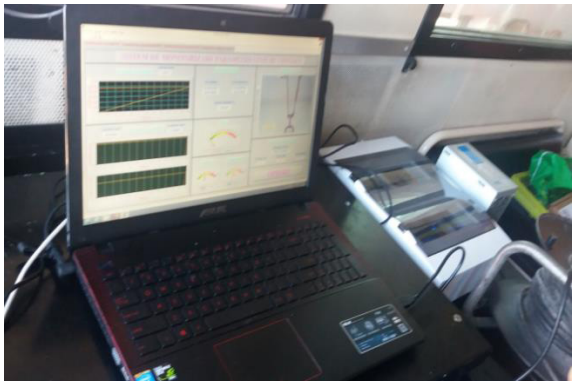
- Study of measuring means of geometric parameters and specific dynamic regimes the contact line (CL), taking into account the its operation under the voltage of 27,5 kV;
- Designing the measurement and data acquisition system based on the constructive and functional characteristics of the pantograph-draisine;



- Implementation of the measurement and data acquisition system under laboratory conditions for functional analysis, tests, corrections;

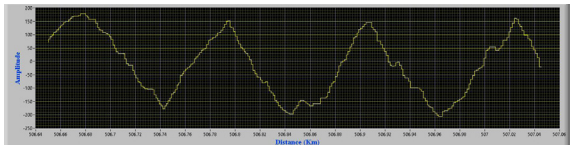


- Installing on the pantograph-draisine of the measurement and data acquisition system of the main parameters required for the CL diagnosis;




- Design and realization of an expert system for automatic diagnosis of the CL;

- Industrial testing of intelligent system for automated diagnosis of the CL;



- Transferring the results to the economic agent.

Results

- Industrial system for measurement and acquisition of data on rail mounted pantograph-draisine in the sector of CL Ilia;
- Expert system for automatic diagnosis of CL in railway electric transport;
- Intelligent system documentation for automatic diagnosis of CL from railway electric transport containing: technical documentation, measurement sets and result of measurement processing;
- 11 scientific articles published in the volumes of international conferences/journals.

Applicability and transferability of the results

The system is designed to be mounted on any pantograph-draisine of the equipment maintenance sectors in the CL and performs measurements and primary data processing automatically daily at various draisine movement at works. Subsequently, the database is transferred and analyzed on a computing system at the headquarters of the sector for a technical analysis of the traveled path and the detection of critical areas.
The system was transferred to the beneficiary and was mounted on pantograph-draisine in the CL Ilia sector.

Financed through/by

PNCDI III - Programme 2 - Subprogramme 2.1. Competitiveness by research, development and innovation
Transfer of Knowledge to the Economic Agent "Bridge Grant" 2016

Research Center

NU

Research team

PROJECT LEADER:
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PROJECT MEMBERS:
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THE RELATIONSHIP BETWEEN ENERGY INVESTMENTS, SHOCKS IN ENERGY PRICES AND THE MACROECONOMY IN THE EU COUNTRIES (EIP-MACRO)

Goal of the project:

Energy prices record high fluctuations increasing market uncertainty. The central role of oil prices in influencing consumption, investments and macroeconomic policies requires special attention. In this context, the main goals of the project are: (i) to analyze the investment behavior and TFP of energy sector companies using firm-level data; (ii) to investigate the non-liner interactions between oil prices and the macroeconomy; (iii) to assess the environmental impact of energy policies, EU regulations and renewable energy consumption.

Short description of the project:

The project aims to provide a deeper understanding of the energy and environmental economics issues, analyzing the interactions between energy prices and the macroeconomy.

Project implemented by

Politehnica University Timișoara

Implementation period:

02.05.2018 – 30.04.2020

Main activities:

a) Development of research on three directions:
- determinants of investments and TFP of energy companies
- macroeconomic impact of oil price shocks
- environmental impact of energy policies.

b) Manipulation of AMADEUS statistics for firm-level data and EIA statistics at macro-level

c) Econometric analyses and generation of results

d) Collaboration with international researchers

e) Dissemination of results in conferences and high-ranked journals.

f) Project management including the establishment of research tasks, identification of dissemination opportunities and research stages.

Results:

a) Interim report no. 1

b) Publications

• ISI journals papers:
- Grecu, E., Aceleanu, M.I. and Albulescu, C.T., 2018. The economic, social and environmental impact of shale gas exploitation in Romania: A cost-benefit analysis, Renewable and Sustainable Energy Reviews, 93, 691-700. (Q1)
- Albulescu, C.T. and Pépin, D. (2018). Monetary integration, money demand stability and the role of monetary overhang in forecasting inflation in CEE countries, Journal of Economic Integration, 33(4), 841-879.

• BDI journals papers:
- Albulescu, C.T., Tămășilă, M. and Vartolomei, M. (2018). Value added and productivity determinants in the water industry: Panel data evidence from the West region of Romania, Scientific Bulletin of Politehnica University of Timisoara, Transaction on Engineering and Management, 4(1), 8-13

c) Conference participations:
- 5th Annual Scientific Conference of Romanian Academic Economists from Abroad (ERMAS 2018)
- 20th INFER Annual Conference
- Conference on Resilience of emerging market economies to global financial conditions

d) Research stages:

Claudiu Albulescu (Université de Poitiers, CRIEF)

Applicability and transferability of the results:

The results of the project have both a micro- and a macro-level applicability. In the first case, the strategic management of companies activating in the energy field will benefit from a deeper understanding of elements influencing the level of investment in the industry. In the second case, national and international regulators and policy makers receive information about the impact of shocks in energy prices on inflation and exchange rate, but also about the effectiveness of environmental regulation and the role of renewable sources in reducing CO2 emissions at EU level.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research Center

Research Center in Engineering and Management

Research team

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INCREASING THE INSTITUTIONAL PERFORMANCE OF THE POLITEHNICA UNIVERSITY TIMIȘOARA BY STRENGTHENING THE R & D AND TECHNOLOGICAL TRANSFER CAPACITY IN THE FIELD OF "ENERGY, ENVIRONMENT AND CLIMATE CHANGE"

Goal of the project

The overall objective of the PERFORM-TECH-UPT project is to increase the institutional performance of the Politehnica University Timișoara (UPT), by developing the R & D capacity of the Research Institute for Renewable Energy, a structure of UPT, by expanding and consolidating its activities in the field of intelligent specialization Energy, Environment and Climate Change, to serve the innovation requirements of economic operators from Romania West Development Region, respectively by intensifying the collaboration and visibility at national and international level.

Short description of the project

The PERFORM-TECH-UTP project is dedicated to UPT's institutional development by supporting human resources, developing R & D infrastructure, promoting and increasing UPT's international visibility.

Project implemented by

Politehnica University Timișoara

Implementation period

October 16th, 2018 - December 10th, 2020 (26 months)

Main activities

- Project management and coordination
- Acquisition of significant R&D equipment and services
- Financial support for attending prestigious international conferences
- Stimulate the publication of articles in WOS indexed journal, located in the Q1
- Stimulation of the doctoral research activity of the last year of internship for the successful completion of the experimental part of the thesis
- Identifying funding opportunities for research and the development of successful applications
- Development of a portfolio of new products / technologies / methods / systems / services or significantly improved
- Selection of postdoctoral researchers in the field of the project
- Integration and testing of purchased equipment within research centers / laboratories
- Creating the site www.research.at.upt.ro

Results

- Elaboration of common multidisciplinary research directions, harmonized with the strategic plan of UPT
- Improving RDI infrastructure
- Testing of RDI infrastructure equipment
- Developing articles indexed in ISI journals
- Increasing the international visibility of UPT by participating in prestigious international conferences
- Supporting young researchers in areas of intelligent specialization

Financed through/by

Ministry of Education, "Program 1 - Development of the National Research and Development System, Subprogram 1.2 - Institutional Performance", National Plan for Research, Development and Innovation for the period 2015-2020 (PNCDI III), Institutional Development Project - CD Excellence Funding Project.

Research centre

1. Research Institute for Renewable Energy
2. Research Centre for Smart Energy Conversion and Storage
3. Research Centre for Mechanics of Materials and Structural Safety
4. Research Centre for Processing and Characterization of Advanced Materials
5. "Ștefan Nădăsan" Research Laboratory for Strength, Integrity and Durability of materials, structures and conductors.

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RANSFER OF KNOWLEDGE TO INCREASE THE OPERATING TIME OF THE STORM PUMPS FOR THE WASTEWATER SYSTEMS - "TANAGRA"

Goal of the project:

The storm pump blades were catastrophically destroyed due to clogging impeller. The fastening bolts of the blade broke fragile due to increased torque to the pump shaft. The project provides solutions to increase the operation time of the storm pumps. The solutions of the project cover three areas: (1) the hydrodynamic point of view to reduce the risk of clogging the impeller by analyzing the flow into the suction elbow geometry; (2) the mechanical point of view to increase the mechanical strength of the solution on fixing the impeller blades on pump hub; (3) an emergency shutdown procedure is targeted when the pump impeller is clogged with testing a technique of the impeller self-cleaning.

Short description of the project:

A strategy of urban sewage centralized management is implemented in Timisoara city. All wastewater is collected and conveyed to a central location for treatment or disposal. In urban area, storm water is considered in wastewater management. Seven storm pumps are installed in the wastewater treatment plant to protect it against floods. Several catastrophic events have occurred at the storm pumps tacking them out of service after short operation period. The catastrophic events were investigated and several solutions have been proposed to increase the operation time of the storm pumps installed in water treatment plant.

Project implemented by

- Politehnica University Timişoara (UPT) together with AQUATIM Timişoara

Implementation period:

September 2016 – November 2018

Main activities:

The main activities were focused on: (1) investigation and analysis the technical solutions associated to the storm pumps available in situ; (2) numerical investigation of the flow into the pump; (3) experimental investigation of the waste and debris collected from wastewater; (4) analysis of the material and mechanical solution implemented in situ; (5) experimental investigations performed in situ to measure the electrical parameters of the pump; (6) assessment of the technical solutions implemented in situ. Also, several undergraduates and master students from UPT visited the sewage treatment plant understanding the new challenges faced by communities and authorities.

Results:

Micota D., Gălățanu S.V., Marşavina L. and Muntean S. (2018) *Evaluation of the mechanical properties and failure mechanism of fibres formed in municipal wastewater systems*, 7th Int. Conf. on Advanced Materials and Structures (AMS2018), 28-31 March 2018, Timisoara, Romania.

Hedeş A., Svoboda M., Anton L.E., Muntean S. and Vitan D., (2018) *In situ measurements on the axial pumps motors of a wastewater station*, 18th Int. Conf. on Environment and Electrical Engineering, 12-15 June 2018, Palermo, Italy.

Gălățanu S.V., Muntean S., Marşavina L., Micota D. and Drăghici I. (2018) *Integrity Analysis of the Rainwater Pump Impeller*, 5th Int. Conf. of Engineering Against Failure (ICEAF V), 20-22 June 2018, Chios, Greece.

Muntean S., Bosioc A.I., Marşavina L., Gălățanu S.V., Drăghici I. and Anton L. E. (2018) *Failure analysis of the rainwater axial pumps installed in a wastewater pumping station*, 29th IAHR Symposium on Hydraulic Machinery and Systems (IAHR2018), 16-21 September 2018, Kyoto, Japan.

Bosioc A.I., Moş D., Draghici I., Muntean S. and Anton L.E. (2018) *Experimental Analysis of a Pump Equipped with an Axial Rotor with Variable Speed*, 29th IAHR Symposium on Hydraulic Machinery and Systems (IAHR2018), 16-21 September 2018, Kyoto, Japan.

Muntean S., Marşavina L., Hedeş A., Anton L.E. and Vlaicu I. (2018) *In situ investigations and failure analysis of the rainwater pumps from a wastewater treatment plant*, 20th Int. Conf. on Hydropower Plants, 14-16 November 2018, Vienna, Austria.

Ognean D., Moş D.C. and Muntean S. (2018) *Technical solution to increase capacity of the centrifugal pumps operated in the protection system against flooding due to climate change*, 20th Int. Conf. on Hydropower Plants, 14-16 November 2018, Vienna, Austria.

Gălățanu S.V., Muntean S., Marşavina L, Ailinei I., and Micota D. (2019) *Rainwater propeller pumps structural integrity*, International Journal of Structural Integrity (accepted).

Applicability and transferability of the results:

Two technical solutions resulting from the research in the project were implemented in situ. First, the suction elbow installed to each pump inlet was removed in order to diminish the impeller clogging. Second, a new softstarter was installed to detect the clogging level of the pump impeller. A self-cleaning procedure is applied if the threshold clogging level is reached. Also, a mechanical solution to increase the mechanical strength of the solution on fixing the impeller blades on pump hub is proposed. However, this solution would be implemented in situ after the performances of the first two technical solutions already implemented are assessed.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI) / Ministry of Research and Innovation

Research Center

Research Center for Engineering of Systems with Complex Fluids, UPT

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INCREASING COMPETITIVENESS OF COLTERM BY OPTIMIZING VARIABLE SPEED CONTROL TECHNOLOGY OF LARGE POWER CENTRIFUGAL PUMPS FOR HEATING

Goal of the project

The objective of this project is to integrate the new modern assemblies pump-electric motor-converter with variable speed control technology in the transport network of the thermal energy from Timișoara and the efficient operation of the entire transport network of the thermal energy.

Short description of the project

The objectives of this project are the integration of the two modern assemblies in the transport network of the thermal energy from the city of Timișoara together with the efficient operation of the entire heating network. To achieve these objectives an experimental investigation will be carried out for the designated pumps from the transport system of the thermal energy from the two CET in order to obtain characteristic curves of operation.

Main activities

There are three main activities.
The first one is to determine a protocol for experimental investigation of centrifugal pumps and to apply it on a couple of pumps from the Laboratory of Hydraulic Machines.
The second one is to investigate the pumps from CET Centru and establish the best operating pattern for these pumps.
The third one is to investigate the pumps from CET Sud and establish the best operating pattern for these pumps.

Project implemented by:

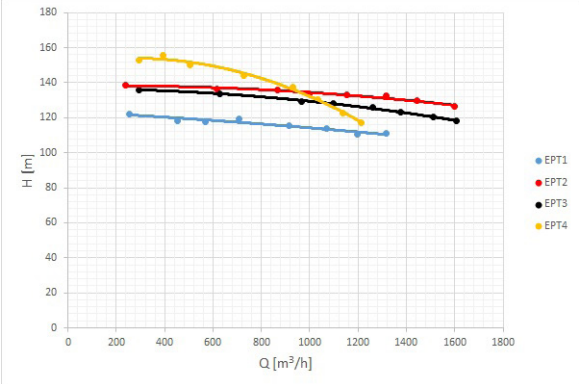
The project is implemented by a team from the Politehnica University Timișoara.

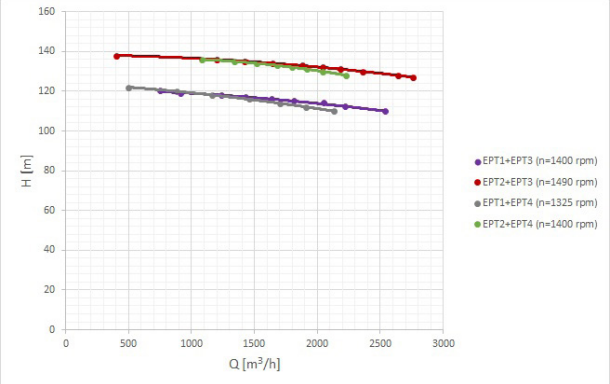
Implementation period

30/09/2016 - 30/09/2018

Results

The estimated results of this project are the operating patterns of the centrifugal pumps from CET Centru and CET Sud and the best efficient operating pattern of these pumps. Until now, the pumps from CET Centru were investigated and the results are presented in the next three figures. In the first figure, we have the operating curves of the four centrifugal pumps from CET Centre. In the second figure, we have the best operating pattern for these four pumps.





Applicability and transferability of the results:

The best operating patterns of the centrifugal pumps from CET Centru and CET Sud will help Colterm to operate these pump at best efficiency in order to supply the necessary domestic hot water and thermal energy for the citizens of Timisoara. By doing this, Colterm will optimize the cost with electric energy.

Financed through/by

CNCS – UEFISCDI, project number 69BG/2016/, project code PN-III-P2-2.1-BG-2016-0190

Research Center

Research Centre for Complex Fluid Systems Engineering

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INOVATIVE METHOD FOR LANDFILLING OF MUNICIPAL SOLID WASTE INCINERATION RESIDUES BY STABILIZATION/SOLIDIFICATION INTO COAL FLY ASH ROCK MATRIX RESULTED FROM DENSE SLURRY TECHNOLOGY

Goal of the project

The project goal is treatment of MSWI residues by stabilization/solidification by means of using a binder matrix. The aim of this process is to create new compounds in a stabilized form that encompassing the harmful elements, which are non-hazardous or less hazardous than the raw (initial) material.
Project includes a series of experiments for embedding the MSWI residues into the coal fly ash rock matrix with the support of the preview research results. There will be done a small scale landfill disposal, in order to investigate the leaching behavior on environmental conditions for tracking the pollutants concentrations migration into environment.

Short description of the project

The project concept is based on using fly ash and desulphurization products related to coal incineration as a binder material to stabilize through solidification process the pollutants (heavy metals mostly) contained in MSWI residues.

Project implemented by

Politehnica University Timişoara

Implementation period

01.05.2018 - 30.04.2020

Main activities

The main activity of the project is to assess the discharge behavior of the experimental landfill disposal exposed into environmental conditions.
In this demand the following activity were foreseen:

- Construction of the experimental demonstrator.
- Evaluate the waste characteristics.
- Construction of the experimental landfill disposal according to the proposed technology.
- Leaching and percolation sampling.
- Lab analyses of experimental samples. Data recording.
- Processing and analyses of the experimental data.
- Interpretation of experimental data.
- Model the environmental behavior of the waste.
- Validate the model by calibration with the results from laboratory tests and field experiments and by comparing it to natural analogues.

Results

Stage I (2018) – Up-grading the existing lab demonstrator. Technical design. Purchasing of equipment.

1.1 Preparation of design documents.
1.2 Designing installations for upgrading the experimental demonstrator in accordance with the proposed technology.
1.3 Elaboration of technical datasheets for equipment purchasing.
1.4 Launch of the public procurement procedure in accordance with the legislation in force.
1.5 Reception of purchased equipment. Equipment payment.

Stage II (2019) – Construction of experimental demonstrator (upgrade). First run. Testing. Lab analyses

2.1 Integration on technological assembly

Applicability and transferability of the results

The solidification/stabilization method of different types of toxic residues consists of using a binder matrix, which is non-pollutant for the environment with the aim to encapsulate the harmful chemical compounds.

In this regard most of the applied technologies are using cement based binder matrix material which is an expensive material in comparison with coal fly ash and associated flue gas desulphurization (FGD) by-products related to coal power plants.

In fact the coal fly ash and FGD by-products are residues that end into open landfill disposal, which means that are costs free.
More than that is well known that cement factory worldwide are using coal fly ash as material basis for different types of cements, for their cementitious properties given by the pozzolanic compounds like silica (SiO_2), alumina (Al_2O_3), and iron oxide (Fe_2O_3) that exceeds over 80% of the fly ash composition.

The new proposed technology based on using fly ash and desulphurization by-products related to coal incineration as a binder material according to solidification/stabilization method, will eliminate the costs with the cement, which could bring considerable economical savings.

From environmental point of view the incineration residues (fly ash and FGD by-products) related to coal incineration can be used as binder material according to the proposed concept of solidification/stabilization method, with the aim to prevent ground water pollution by leaching phenomenon developed on open landfill disposals by dense slurry technology.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding – UEFISCDI /
PN-III-P1-1.1-PD-2016-1093

Research centre

Research Institute for Renewable Energies – ICER

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Mentor:
Prof. Daniel DAN, PhD

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AFFORDABLE AUTONOMOUS UNDERWATER VEHICLE (AUV) FOR SEARCH, INSPECTION AND MAINTENANCE OPERATIONS IN TURBID UNDERWATER

Goal of the project:

Developing an underwater enhancing technique that can work in real-time for affordable Autonomous Underwater Vehicle (AUV)

Short description of the project:

Autonomous Underwater Vehicles (AUVs) are devices able to follow a predefined route or is computing and adjusting the route as a result of sensor measurements. They were developed and used successfully on various applications; such as oceanographic surveys, bathymetric measurements, underwater maintenance and inspections activities (e.g. of the hydroelectric dams, bridges, sea wind turbines and oil sea platforms structure). Taking advantage of the latest advances in hardware and software, an ever-increasing number of underwater studies rely on AUVs that offer increased operational range and reduce potential hazards compared to classical methods involving divers or manned submersibles.

However, the existing AUVs performances are currently very limited due to the poor underwater visibility. In general the existing restoration techniques are too computationally expensive for AUVs. This project proposes a radically novel paradigm that provides the basis for more direct, interactive and efficient underwater studies, while reducing the associated costs. The technologies developed in the context of this project will allow the scientists to directly study, in an immersive way and in real-time, the environment surveyed by the AUVs, while allowing remotely interacting with the vehicle in a natural and intuitive manner.

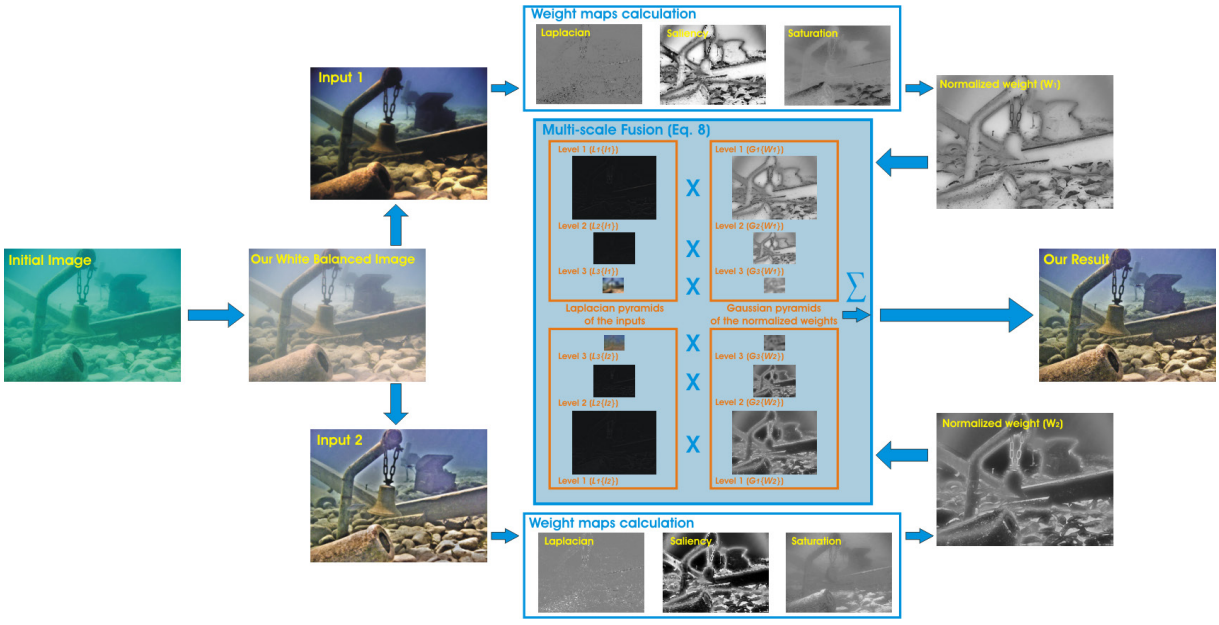

Figure 1: Overview of the proposed method.

Project implemented by

Politehnica University Timișoara, Romania

Implementation period:

January 2017- June 2018

Main activities:

The main activities of the project:
- identification of specific requirements of underwater imaging technique to be implemented on a specific hardware platform;
- design of an exploration path for specific functionalities;
- designing and recording of specific underwater image scenarios;
- implementation of the underwater imaging technique;
- optimize and integrate the underwater enhancing technique;
- publish the results;

Results:

- Developing an effective underwater enhancing technique
- 2 WOS/ISI papers and 1 BDI paper
- 1 ISI journal (IEEE Transactions on Image Processing, Q1, impact factor 4.8)

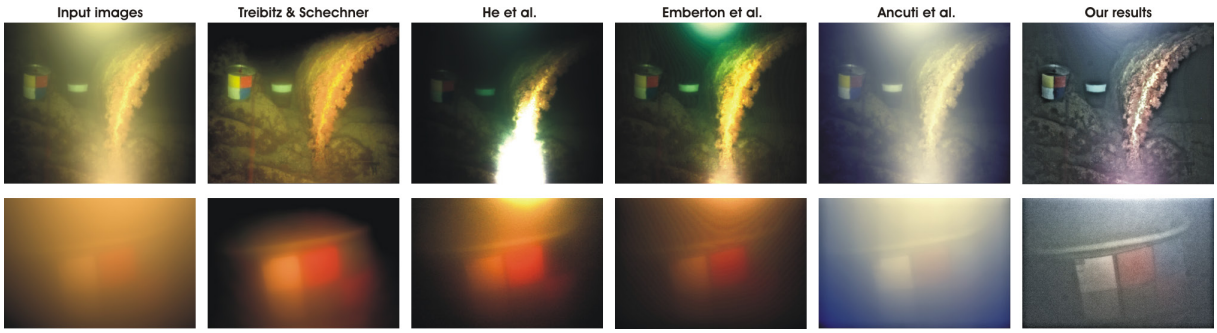

Figure 2: Underwater dehazing of extreme scenes characterized by non-uniform illumination conditions.
Our method performs better than earlier approaches of Treibitz and Schechner, He et al., Emberton et al. and Ancuti et al

Applicability and transferability of the results:

The outcome of this project may be applied in the field of underwater imaging and in the AUV's industry.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania

Research Center

Research Center of Intelligent Systems

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RESEARCH CONCERNING CHARACTERIZATION AND IMPROVEMENT OF THE ELECTROMAGNETIC ENVIRONMENT IN MODERN CARS

Goal of the project

- Assessment of the electromagnetic environment in modern vehicles: technical and legal aspects;
- Assessment and analysis of measuring and testing methods and of equipment involved in Automotive EMC;
- Implementation of novel test and measurement methods in Automotive EMC and improvement of the testing repeatability
- Applications of metamaterials to Automotive EMC.

Short description of the project

This project is component of the complex project *Hybrid Platform for Communication in Visible Light and Augmented Reality for the Development of Intelligent Systems for Assistance and Active Security of Vehicles*, 21PCCDI / 2018.

Project implemented by

Politehnica University Timişoara,
Faculty of Electronics, Communications and Information Technology,
Department of Measurements and Optical Electronics

Implementation period

18.05.2018 - 16.11.2020

Main activities

1. Characterization of the electromagnetic environment in vehicles:
   - Near field and far field measurement;
   - Spectral occupancy measurement.
2. Improvement of repeatability of Automotive MC tests
   - Assessment of devices and equipment involved;
   - Interlaboratory testing and comparisons
   - Far-field prediction from near-field measurements data;
   - Prediction of far-field radiation from current measurement.
3. Methods of reduction of conducted and radiated emissions;
   - Resonance analysis of systems that fail EMC tests;
   - Applications of metamaterials: filtering, suppressing of cavity oscillations, screening with frequency selective surfaces.

Results

2018

- Documentation concerning assessment of electromagnetic field in modern cars;
- Documentation concerning foreseen electromagnetic environment in electric cars and related EMC aspects;
- Documentation concerning applications of metamaterials in the Automotive EMC field;
- 10 published papers on:
  - Emissions and immunity testing in Automotive EMC (Fig. 1);
  - Interlaboratory comparison of radiated emissions;
  - ALSE chamber validation (Fig. 2);
  - Stripline measurements in Automotive EMC;
  - Near field measurements and applications to emission reduction (Fig. 3);
  - Frequency selective surfaces;
  - Spectrum occupancy measurement in the HF domain;
  - Application of Rasberry Pi.

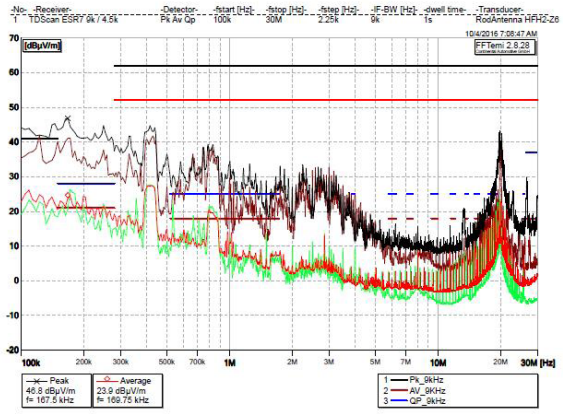

Fig. 1. Results of radiated emission tests on the same DUT using a monopole antenna in two different semi-anechoic chambers.

Fig. 2. Testing setup for chamber validation with biconic antenna

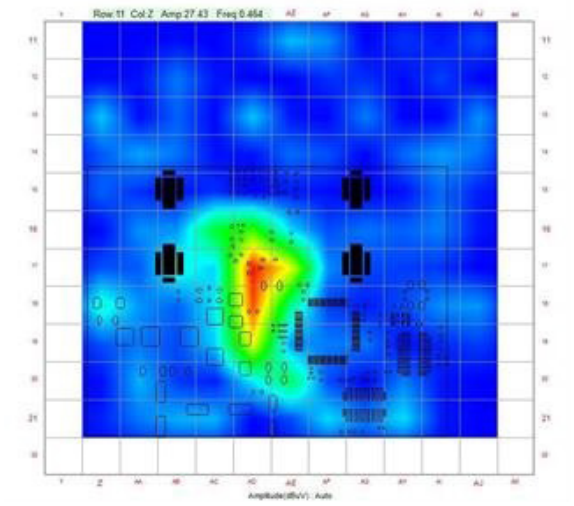

Fig. 3. Near-field scanning

Applicability and transferability of the results

Results obtained in this research might be useful to:
- EMC laboratories, mainly related to Automotive industry;
- EMC professionals;
- EMC research community;
- EMC standards elaboration;
- Legal authorities that regulate spectrum occupancy;
- Professionals working in Automotive design.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research centre

ICER - Research Institute for Renewable Energy

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TRANSFER OF KNOWLEDGE FOR FATIGUE STRENGTH EVALUATION OF STEERING WHEELS SKELETON

Goal of the project

- Interconnection of the expertise of the project team from Politehnica University Timișoara with the quality assurance requirements of TRW Company for the steering wheels.
- Transfer of knowledge regarding the static and dynamic characterization of Magnesium alloys.
- Intensification of the cooperation between Politehnica University Timișoara and TRW Company for understanding of mechanical behavior and for the implementation of a methodology to assess the durability of steering wheel skeletons.

Short description of the project

The project propose a transfer of knowledge from the experts from Politehnica University Timișoara in order to implement the methodology to determine the fatigue strength of steering wheel skeleton.

Project implemented by:

Politehnica University Timișoara and
TRW AUTOMOTIVE SAFETY SYSTEMS SRL (Economic partner)

Implementation period

30/09/2016-29/09/2018

Main activities

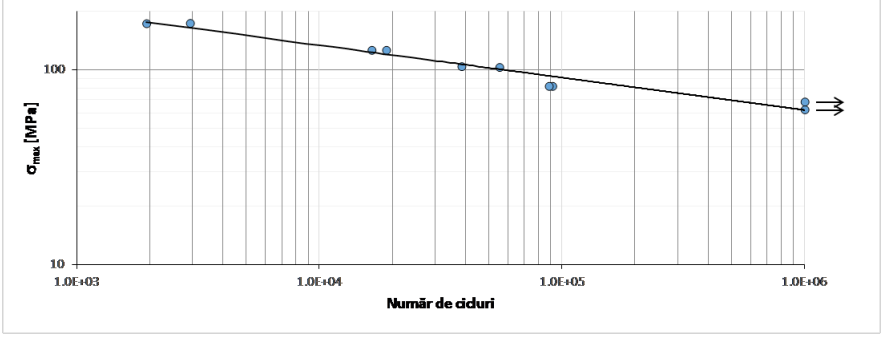
- Interconnection of the expertise of the project team from Politehnica University Timișoara with the quality assurance requirements of TRW Company for the steering wheels.
- Mechanical characterization and determination of static and dynamic properties of Magnesium alloys used for steering wheels.
- Elaboration of material models for Magnesium alloy AM50. Numerical estimation of durability of steering wheel skeletons.
- Practical training of master students from Politehnica University Timișoara on modern equipment of TRW company.

Results

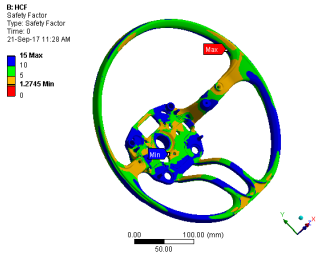
The TRW company will implement a methodology to evaluate the fatigue strength for the steering wheels skeleton made of Magnesium alloys and will be able to perform in-house tests at the Timișoara branch.

After the project implementation the TRW company will receive a methodology to assess the static and dynamic characteristics of Magnesium alloys. Also, will be developed the methodology to assess the fatigue strength of steering wheels skeletons. Very important results are represented by fatigue curves for Magnesium alloy, which could be useful in the design stage to perform numerical durability studies.

Participation at two international conferences ARTENS - Sibiu 2016 and ICSID - Dubrovnik 2016. Publication of the paper FATIGUE ANALYSIS OF MAGNESIUM ALLOYS COMPONENTS FOR CAR INDUSTRY, Authors L. Marsavina, L. Rusu, D. Serban, R. Negru, A. Cernescu, ACTA UIVERSITATIS CIBINIENSIS – TECHNICAL SERIES Vol. LXIX 2017, p. 47-51



Fatigue curve on tensile loading for AM50 Magnesium alloy



Safety factor under fatigue loading

Applicability and transferability of the results:

The TRW company will implement a methodology to evaluate the fatigue strength for the steering wheels skeleton made of Magnesium alloys and will be able to perform in-house tests at the Timișoara branch. After the project implementation the TRW company will receive a methodology to assess the static and dynamic characteristics of Magnesium alloys. Also, will be developed the methodology to assess the fatigue strength of steering wheels skeletons. Very important results are represented by fatigue curves for Magnesium alloy, which could be useful in the design stage to perform numerical durability studies.

Financed through/by

Bridge Grant PN-III-P2-2.1-BG-2016-0060, Contract 89BG/2016 89 by Romanian Ministry of Research trough UEFISCDI

Research Center

ICER

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TRANSFER OF KNOWLEDGE FOR DASHBOARD AND HEAD-UP DISPLAY OPTIMIZATION THROUGH TESTING AND MODELLING OF ADVANCED MATERIALS

Goal of the project

The goal of the project is the determination of strain rate and temperature variation in mechanical properties of several advanced materials used in vehicle instrument clusters and Head-Up displays. With the gathered experimental data, non-linear material models are to be developed for the use in finite element analysis of various components during the product design stage.

Short description of the project

This project deals with the mechanical characterization and numerical simulations of advanced materials used in the automotive industry

Project implemented by:

This project is implemented by Politehnica University Timișoara with the support of Continental Automotive Romania.

Implementation period

01/10/2016 – 31/03/2018

Main activities

01. Determination of the mechanical and thermal properties of the investigated materials
- Static tests (determination of the influence of strain rate and temperature)
- Fatigue tests
- DMA tests

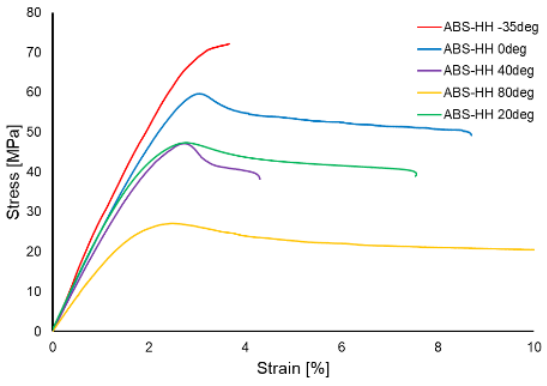
02. Development and evaluation of constitutive models used in simulations
- Development of constitutive models based on the gathered experimental data
- Evaluation of the developed material modes through experiment replication

03. Implementation of the constitutive models in product simulations
- Analysis of simulation results and comparison with experimental data
- Identification of optimal models from an accuracy and simulation time standpoint

04. Development of procedures for facilitating the introduction of new materials
- Establishment of a test benchmarks
- Proposal of easy-to-calibrate material models for simulating new materials

Results

In this project, the experimental procedures determined the mechanical properties of 5 materials. The strain rate influence on the tensile and flexural properties was investigated in the range of 2 – 200 mm/min test speed, showing a noticeable influence on the strength and stiffness of the materials. The materials were also tested in a temperature range of -35 °C to 80 °C, showing significant variation is strength, stiffness and also in behavior (Figure 1).



Other experimental procedures included DMA tests and the determination of the Poisson ratio.

The gathered experimental data was used to calibrate elastic-plastic material models for finite element analysis simulations. Temperature and strain-rate dependency was integrated in the models, the material evaluation showing good agreement with the experimental results.

Applicability and transferability of the results:

The aim of the Bridge Grant was to directly aid companies through the transfer of knowledge, all results being delivered to the project partner:

- The experimental results were supplied to Continental Automotive Romania, the data being used in the material selection process in product design.
- The proposed material models will be used by Continental Automotive Romania in numerical analyses of newly designed components.

Financed through/by

UEFISCDI

Research Center

Ștefan Nădășan Laboratory

Research team

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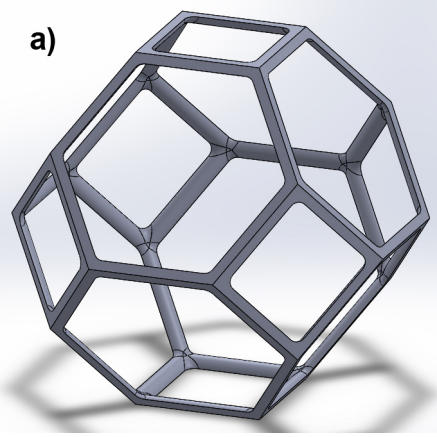
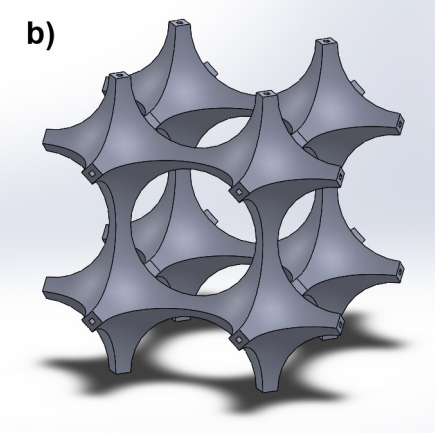
INTELLIGENT CONTROL SYSTEM FOR CONTINUOUS CASTING BASED ON WATER FLOW CONTROL IN THE SECONDARY COOLING

Goal of the project:

This project deals with the development of metamaterial structures composed tessellations of mainly two types of open cells: truncated hexahedron tessellation (the Kelvin structure, a) and hollow sphere tessellation (b). The structures will be modelled using computer aided design software and their mechanical properties will be evaluated using finite element analysis software. When the desired geometries will be developed, the CAD file will be exported to a rapid prototyping machine for manufacturing.





Short description of the project:

This project addresses a subject in the field of innovative materials and it deals with the design and manufacturing of structures composed of engineered materials whose properties are not found in nature (metamaterials). The metamaterials proposed for this project will consist of cellular polymeric lattices, whose properties will be controlled through geometric parameter manipulation (strut thickness, cell size and shape). The main applications of these structures will be as cushioning and protective layers meant to absorb the deformations and impact energy of personal protective equipment. The project has two main stages. The first stage consists of the design and simulation of the structures in order to determine the optimal parameters in terms of mechanical properties. The second stage of the project will deal with the manufacturing of the structures through rapid prototyping and the experimental determination of their mechanical characteristics. The comparison between the estimated and experimentally determined properties will validate the designs of the structures, allowing for complex geometry modelling for actual safety equipment applications.

Project implemented by

Politehnica University Timișoara

Implementation period:

1.5.2018 – 30.4.2020

Main activities:

O1. Literature survey concerning metamaterial structures and additive rapid prototyping techniques.
- A1.1. Literature study concerning mechanical metamaterial structures
- A1.2. Literature study concerning rapid prototyping techniques for polymers

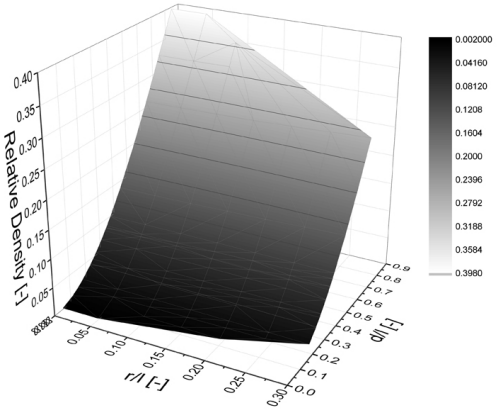
O2. Development of parametrical metamaterial structures
- A2.1. Design of metamaterial structures based on Kelvin cells
- A2.2. Design of metamaterial structures with hollow sphere cells

O3. Numerical evaluation of the mechanical properties of the developed metamaterial structures
- A3.1. Determination of the mechanical properties of the polymers used in rapid prototyping
- A3.2. Evaluation of the static mechanical properties of the developed structures
- A3.3. Evaluation of the impact and energy absorption properties of the developed structures
- A3.4. Optimization of metamaterial structures

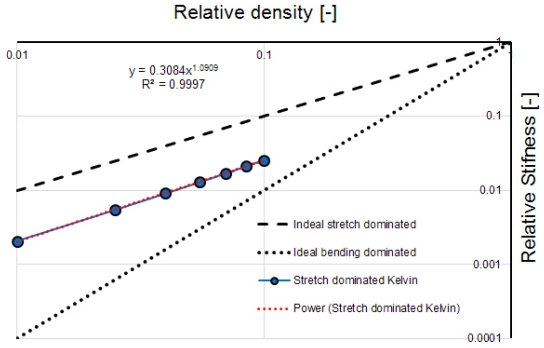
04. Manufacturing of metamaterial structures
    A4.1. Parameter adjustment for structure manufacturing through rapid prototyping
    A4.2. Manufacturing of designed structures through additive rapid prototyping
05. Experimental determination of the mechanical characteristics of the manufactured structures
    A5.1. Elaboration of static tests in compression on the manufactured structures
    A5.2. Elaboration of static tests in bending on the manufactured structures
    A5.3. Elaboration of fatigue tests in compression on the manufactured structures
    A5.4. Elaboration of impact tests on the manufactured structures
06. Structure validation and product component design
    A6.1. Comparison of results and simulation optimization
    A6.2. Design of safety equipment components based on metamaterial structures
    A6.3. Numerical analysis of the designed components' behavior in impact applications

Results:

After the first year of implementation, several structures were generated, and the variation of relative stiffness with the structure parameters was investigated.



The geometries were imported into a finite element analysis software and the relative stiffness and relative strength variation with relative density was determined.
Partial results were published in an article entitled " A parametric study of the mechanical properties of open-cell Kelvin structures" and presented at the international conference AMS18



Applicability and transferability of the results:

The results obtained from this project can be implemented in safety equipment, for various types of industries, such as civil engineering (helmets), sports (protective equipment such as helmets, shin guards, padding), automotive (motorcycle suits) and defense (body and vehicle armor)

Financed through/by

UEFISCDI
Programul 1 - Dezvoltarea sistemului național de cercetare-dezvoltare

Research Center

1. Laboratorul Ștefan Nădășan, Politehnica University Timișoara
2. Medical Engineering Research Center, Politehnica University Timișoara
3. ICER - Research Institute for Renewable Energy, Politehnica University Timișoara

Research team

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Prof. Eng. Nicolae FAUR, PhD

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SMART BUILDINGS ADAPTABLE TO THE CLIMATE CHANGE EFFECTS (CIA_CLIM)

Goal of the project

The specific objective of the project is centred on the increase of energy efficiency of buildings, by using smart facades with low-thermal transfer and smart energy efficiency through building automatization and solar energy collectors, through a modular laboratory demonstrative application. The resulted system, the smart house, is conceived thus to minimize the input energy for maintenance.

Short description of the project

The four component projects are focusing on two principal research directions:

(i) use of smart facades with the low-thermal transfer, actively integrated for the enhancement of internal comfort and possessing a passive control of energy and

(ii) smart energy efficiency through building automatization and solar energy collectors.

CIA.CLIM
clădiri inteligente adaptabile la efectele schimbărilor climatice

Project implemented by

Politehnica University Timișoara as coordinator (CO),
in collaboration with

- Technical University of Civil Engineering of Bucharest (UTCB, P1),
- Technical University of Cluj-Napoca (UTCN, P2),
- National Institute for R & D in Electrical Engineering Bucharest (ICPE – CA, P3) and
- National Institute of R & D for Electrochemistry and Condensed Matter Timișoara (INCEMC, P4)

Implementation period

01.03.2018 - 30.09.2020

Main activities

Project 1 investigates the mechanical properties of cellular materials used as thermal insulations in smart façade systems, through mechanical compression, bending and toughness fracture testing.

Project 2 is focused on obtaining, characterizing and testing of high-property materials used for smart facades as thermal insulation materials and as support for special property layers: photo-catalytic layers and with reduced absorption/reflexion of UV-VIS-IR radiation.

Project 3 investigates the implementation of the electric power distribution in direct current for individual households or in small communities (smart-grid), with renewable energy sources integration.

Project 4 implements the knowledge and data resulted from projects no. 1-3 through a modular laboratory demonstrative application. The project will perform an integrated study on the influence of the facades and the energetic contribution to the internal comfort of the building.

Results

- Determination of mechanical proper-ties of cellular materials used as thermal insulations in smart façade systems;
- Production, characterization and testing of high-property materials used for smart facades as thermal insulation materials and as support for special property layers;
- Implementation of the electric power distribution in direct current for individual households or in small communities (smart-grid), with renewable energy sources integration, finalizing with an experimental platform;
- Modular laboratory demonstrative application for the implementation of project results, performing a global study regarding the influence of the facades and the energetic contribution to the internal comfort of the building.

Applicability and transferability of the results

In the construction domain, the energy represents the key-point in achieving efficient buildings. All the results obtained in the frame of the project are expected to be of interest for the economic environment, from manufacturers to contractors. Design guidelines and recommendations will be provided.

Financed through/by

The project is supported by a grant of the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), project number PN-III-P1-1.2-PCCDI-2017-0391 / grant agreement 30PCCDI/2018.

Research Centre

- ICER - The Research Institute for Renewable Energy, UPT (CO);
- "St. Nadasan" Research Laboratory for Strength, Integrity and Durability of materials, structures and conductors, UPT (CO);
- Research Center of Environmental Science and Engineering, UPT (CO);
- Intelligent Control of Energy Conversion and Storage Research Center, UPT (CO);
- ACTEX - Integrated Platform of Research and Development for the Behaviour of Structures under Extreme Actions, UPT (CO);
- CAMBI - Advanced Research Center for Ambiental Quality and Building Physics, UTCB (P1);
- EEC - Energy Efficiency in Buildings, UTCB (P1);
- RLSDEPE - Research Laboratory and Sustainable Development in Electronics and Power Electronics, UTCN (P2);
- Department for Efficiency in Conversion and Consumption of Energy, ICPE - CA (P3);
- Renewable Energies – Photovoltaics – Laboratory, INCEMC (P4);
- Chemical and Electrochemical Synthesis Department, INCEMC (P4).

Research team

The research team is composed by 90 researchers of the five institutions.

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CENTRALIZING AND OPTIMIZING SCADA IN THE WATER SECTOR (CASCADA)

Goal of the project

The knowledge transfer to Aquatim through software and hardware modules and strategies for centralizing and optimizing SCADA for the water sector.

Short description of the project

The general purpose of CASCADA is the knowledge transfer to the economic operator through software and hardware modules and strategies to solve stated problems in centralizing and optimizing SCADA for the water sector. The project proposes the ICOM module (Interface, Conversion, Optimization, Modularity) as instrument in solving both interfacing and protocol conversion problems and the development of non-invasive optimization modules of controlling groups of objectives already in function in the water sector. Also, in order to improve effectiveness, the project addresses the IGSS SCADA implementation strategy in Aquatim control center and the existing communication system. CASCADA wants to train Aquatim in SCADA/automation/communications new technologies and to practically apply the concepts in a SCADA analysis of three existing objectives of the operator.

Project implemented by

Politehnica University Timișoara

Implementation period

30.09.2016-30.09.2018

Main activities:

The activities are foreseen to implement the following three objectives:
1) Realizing and testing the ICOM module;
2) Optimizing the IGSS control center;
3) Direct knowledge transfer in new technologies.

Results

CASCADA, through the ICOM module will solve the SCADA integrability problems of the economic operator, respectively will provide an instrument, independent of local equipment and SCADA solutions, to answer integrability and functioning optimization issues for groups of interdependent objects as technological flow but independent regarding their implementations. Therefore, due to SCADA correlations of groups of objects (integrations on higher SCADA levels and creating control algorithms for group of objects), the economic operator's systems will be more stable and efficient, respectively the impact of the incidents will be reduced.
Optimizing the IGSS control center will provide the possibility to maximally use the resources available through licensing, an increased communication speed through systematizing the internal Aquatim network, respectively an adequate web based access conferred by the WebNavIGSS module.
CASCADA will impact also the quality of the future investments of the economic operator through opening perspectives to new technologies and optimal solutions, with increased efficiency and reduced costs.
The implemented activities will strengthen the entrepreneurial abilities of researchers and the connection between the academic environment and the industry requirements.

Applicability and transferability of the results

As a bridge grant, the project is strongly industry oriented, with significant practical value and focused on the knowledge transfer to an economic operator.

Financed through/by

UEFISCDI

Research Centre

ICER – Renewable energy research institute

Research team

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NATURE-INSPIRED MODELING AND OPTIMIZATION TECHNIQUES OF FUZZY CONTROL SYSTEMS WITH MECHATRONICS APPLICATIONS

Goal of the project

The aim of this project is to demonstrate efficiency and prove the viability of an innovative tuning approach for fuzzy control systems using nature-inspired algorithms in control structures modeling and optimization stages. In this framework, combining nature-inspired optimization algorithms with fuzzy control structures, will have a significant impact on the performance of fuzzy control systems.

Short description of the project

The nature-inspired optimization algorithms will be employed in solving optimization problems that minimize discrete-time objective functions expressed as integral or sum-type quadratic performance indices.

Project implemented by

Politehnica University Timișoara

Implementation period

19.10.2018 - 18.10.2020

Main activities:

The main activities are:

1. Development of efficient control solutions for different processes by bypassing the higher derivative calculations;
2. Takagi-Sugeno fuzzy controllers' optimization through minimization of several objective functions;
3. Development of performant solutions with a reduced implementation cost;
4. Experimental validation of proposed control solutions;
5. Achievements dissemination in high visibility journals and conferences;
6. Successful project management administration.

Results

The main results are related to development of nature inspired algorithm-based solutions for solving optimization problems of fuzzy systems will be disseminated at national and international levels as: four papers published in Thomson Reuters Web of Science (formerly known as ISI Web of Knowledge) publications and four presentations at international conferences.

Applicability and transferability of the results

The results obtained during this contract belong exclusively to Politehnica University Timișoara.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding

Research Centre

Faculty of Automation and Computers

Research team

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SINTERING OF NOVEL STRUCTURES FOR ALLOYS WITH INCREASED FUNCTIONALITY

Goal of the project

The proposed research involves collaboration based on the complementary experience of the two groups for obtaining sintered materials (including porous or gradient) from the intelligent material family. Focusing is on emphatic forms of the form, including biocompatible (from the NiTi family).

Short description of the project

The collaboration will use the experience of the research groups in Romania and China for the development of new technologies in order to manufacture high-performance intelligent materials.

Project implemented by

- Politehnica University Timișoara
- University of Science and Technology Beijing

Implementation period

2018 - 2019

Main activities:

1. Preparation and characterization of complex metal powders
2. Identify the compatibility between the potentially usable components in making porous structures
3. Establishing technologies for making sintered materials
4. Making and characterization of sintered materials.

Results

Expected results:

- Metal powders and mechanical alloying;
- Couples of materials for porous structures;
- Components with controlled geometry for porosity;
- Conventional, plasma and laser sintering technologies;
- Characterized materials;
- Dissemination.

Applicability and transferability of the results

The results can be applied in the biomedical industry

Financed through/by

UEFISCDI – Romania-China bilateral partnerships

Research Centre

Smart Materials Laboratory

Research team

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DEVELOPMENT OF ECO-FRIENDLY COMPOSITE MATERIALS BASED ON GEOPOLYMER MATRIX AND REINFORCED WITH WASTE FIBRES

Goal of the project

The project is an answer for a specific challenge regarding waste management, recycling and urban mining. The goal of the project is to prepare a broad spectra of advanced and progressive new composite materials based geopolymer matrices and reinforced with natural waste fibres. The application of these new materials will be the construction industry with a high potential of commercial utilization and potential replacement of conventional materials.

Short description of the project

This project deals with the development of new composite materials for construction industry, based on waste products.

Project implemented by:

Project coordinator: Cracow University of Technology.
Partners: Nigde University Turkey, Pontificia Universidad Católica del Peru, Riga Technical University Latvia, Babeș-Bolyai University, Catholic University of Uruguay Damas Antonio Larrañaga, Politehnica University Timișoara.

Implementation period

02/01/2017 – 31/12/2019

Main activities

- WP1. The selection of waste materials for hydrothermal alkalization and therefore to be turned into new materials based on geopolymer matrix for construction applications
- WP2. The selection of waste materials (natural fibres) as a fillers and therefore turned into new composites for construction application
- WP3. Optimization of properties using computer methods for the new materials and structural elements
- WP4. The research into the application of new materials – comparison of the functional properties of the materials
- WP5. Analysis of practical applications of new materials for construction application and testing prototype components in laboratory as well as validated it in relevant environment

Results

The year 2017 had deadlines for the first two Work Packages.
WP1, coordinated by Nigde University, dealt with the identification of waste materials for the composite material matrices. Each participating partner performed a survey of possible waste material candidates available in their region (recycled clay bricks and volcanic ash in Peru, fly ash in Turkey, Argentina and Romania, paper mill sludge and rice husk ash in Uruguay and granulated rubber from waste tyres in Poland).

WP2, coordinated by Babeș-Bolyai University, dealt with the identification of waste natural fibres as reinforcements for the composites. As with WP1, each participating partner proposed waste materials available in their region (mostly hemp and flax fibres).

Applicability and transferability of the results:

The new composite materials that will be developed in this project will be tested and their properties compared with conventional construction materials. If the mechanical and thermal behaviour is comparable between the two categories, the newly developed materials will be proposed for replacing traditional materials in each specific region where the waste products are available.

Financed through/by

Horizon 2020 - ERA Net Latin America and Caribbean Countries/ UEFISCDI

Research Center

Ștefan Nădășan Laboratory

Research team

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